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Successful plan for "selling up" service entrance equipment—pg. 18

JUNE, 1956

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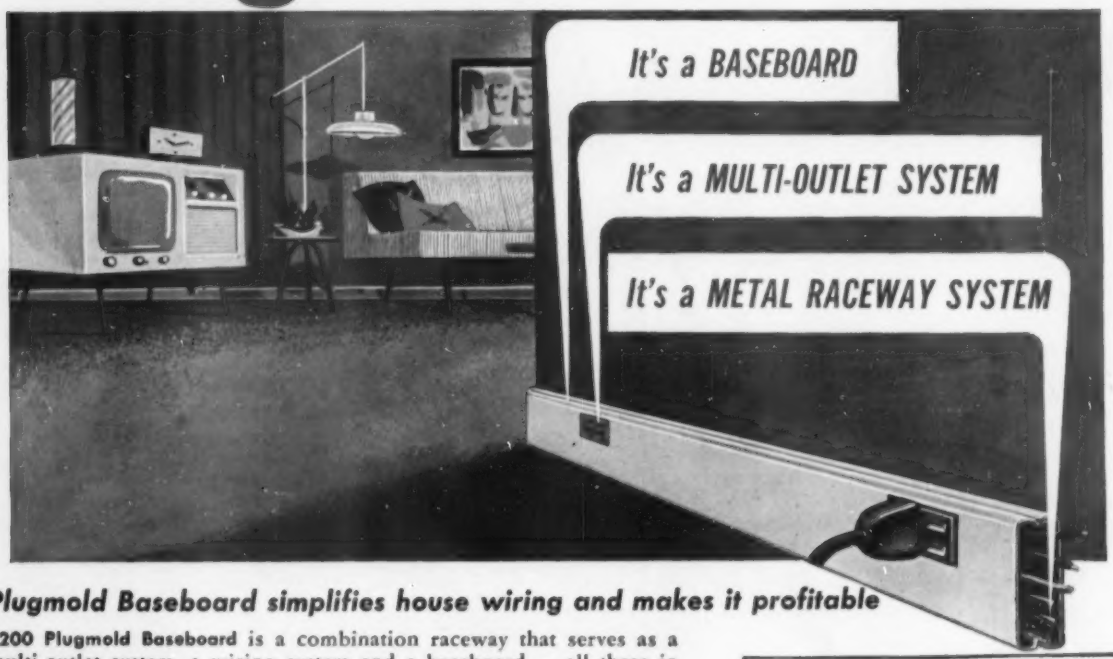

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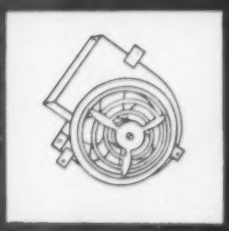

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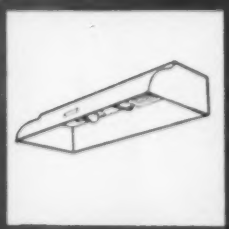

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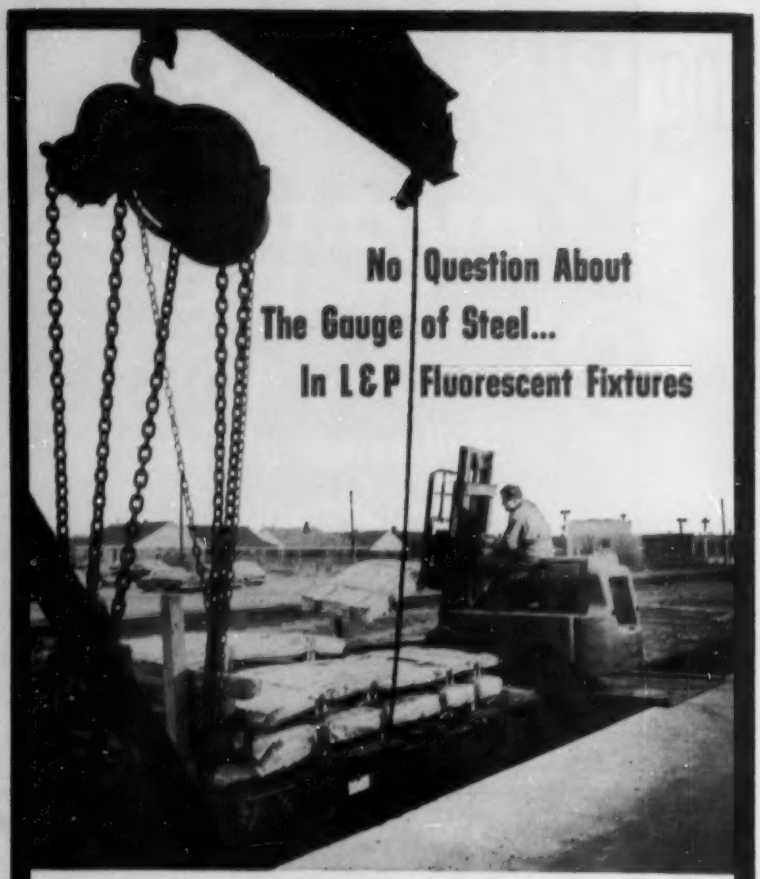
Volume 36 Number 6



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Economic comment

by J. Whitney Bunting, Ph.D.

Contributing Economics Editor

Automobile production

Recent problems in the automotive industry have tended to throw some apprehension into the thinking of economic planners and forecasters. There is basically nothing wrong with the industry itself except in comparison to the banner 1955 production and sales record. It was a known fact that the industry would need some cut back in 1956 to achieve a shade of normalcy in its operation.

The heavy sale of all types of cars in the last six months of 1955, plus the fact that many dealers still had stocks on hand at years end, all added up to less sales volume in 1956. The fact that many of these sales were on a credit basis further accentuated the probable decline in sales volume during the current period.

The two rather shaky elements in the automobile field that deserve watching are:

(1) The announcement by both General Motors and Chrysler Corporation that some production will have to be curtailed with a possible four-day week in prospect; and.

(2) The very precarious nature of Studebaker-Packard's production in the future.

Emotions enter in

The seriousness of both problems has little or no real danger to the economy unless certain psychological problems should arise. For example, the first point is merely a big industry's attempt to realign production into a much more realistic pattern. The end result, with no other disturbing elements present, should be a stronger and more economic production policy. This in itself should serve to strengthen economic conditions both within and without the auto field.

The psychological danger is the fact that business, like other human activity, is highly charged with emotion that can lead the economy into false pathways if so permitted. Failure to recognize the true purpose of this reorganized production pattern and a widespread mistaken belief that it indicates lack of optimism in current economic conditions can cause serious disruptions of the economic state of affairs.

It is anticipated that frequent and intelligent advice from auto manufacturers as to the nature of their problem will allay many fears and will prevent senseless emotional situations from future development.

The solution of the Studebaker-Packard dilema is anticipated at an early date (perhaps before this column is published). These two old time automobile producers have long been considered a substantial part of the industry. Both have represented quality workmanship and the values of the American way of life. That they may jointly be submerged into oblivion because of economic distress is certainly a regrettable situation. Yet this too is not indicative of an inherent economic weakness. The danger again lies in an emotional nostalgia that might rise up and serve to becloud the prevailing economic strength of the future.

It is always a matter of regret to see old industrial friends in financial hardship, and it is to be hoped that a way will be found to re-establish them in a strong economic position. This may be done by consolidation or merger, the most likely prospect.

Size is necessary in auto manufacture today. Not only size in plant and personnel, but also size in the area of finance. President Nance estimates that $50 million of new money can save the day. Less than this amount might only stave off the inevitable. But regardless of the results of this situation, the Studebaker-Packard dilemma is not a sign of economic weakness, but rather an indication of an industrial concern that cannot measure up to today's competition.

Which way the market?

There is generally an attempt in this column to avoid much mention of the stock market and the possibilities of a rise or fall in the price level. It is a policy that is healthy for it seems more important to discuss basic economic issues that have a bearing upon business health rather than actual situations in specific economic areas.

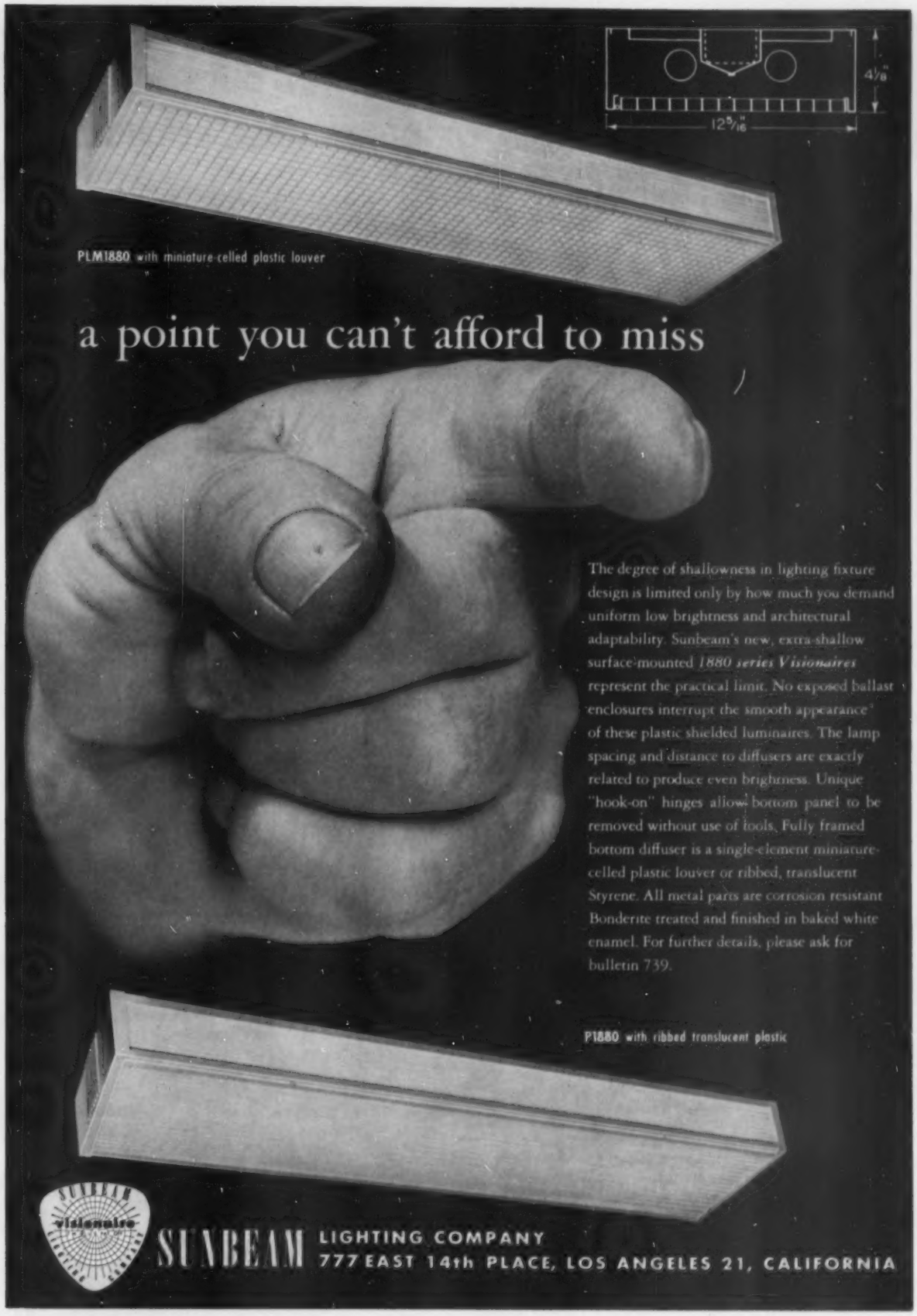
However, interest is presently tied up with the seeming plateau that stock prices have reached in recent weeks. True, there is still evidence of price appreciation in particular corporate issues. Yet there is a "softness" in others that has led the averages to hover around a steady level.

Whenever such "softness" appears, many observers immediately foresee a decline in general stock prices and attempt to unload certain issues that they deem inflated or over-priced.

The situation at present is one that has been expected and indicates no serious condition on the market. Rather it presents a shake-down period for numerous issues that may have appreciated rather rapidly during the past few months. Many of these securities reached new highs during the first quarter and some settling is necessary under a free market condition. Moreover, the market this year has seen unusual circumstances develop, such as the marketing of the Ford stock, many of which have caused new interest in the field of investment.

One can look forward to an extension of this plateau period for several weeks after which the market can reasonably be expected to return to normalcy. The inherent strength of industry is not an issue. The values behind security prices are sound and further price appreciation may be anticipated by the close of the year.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.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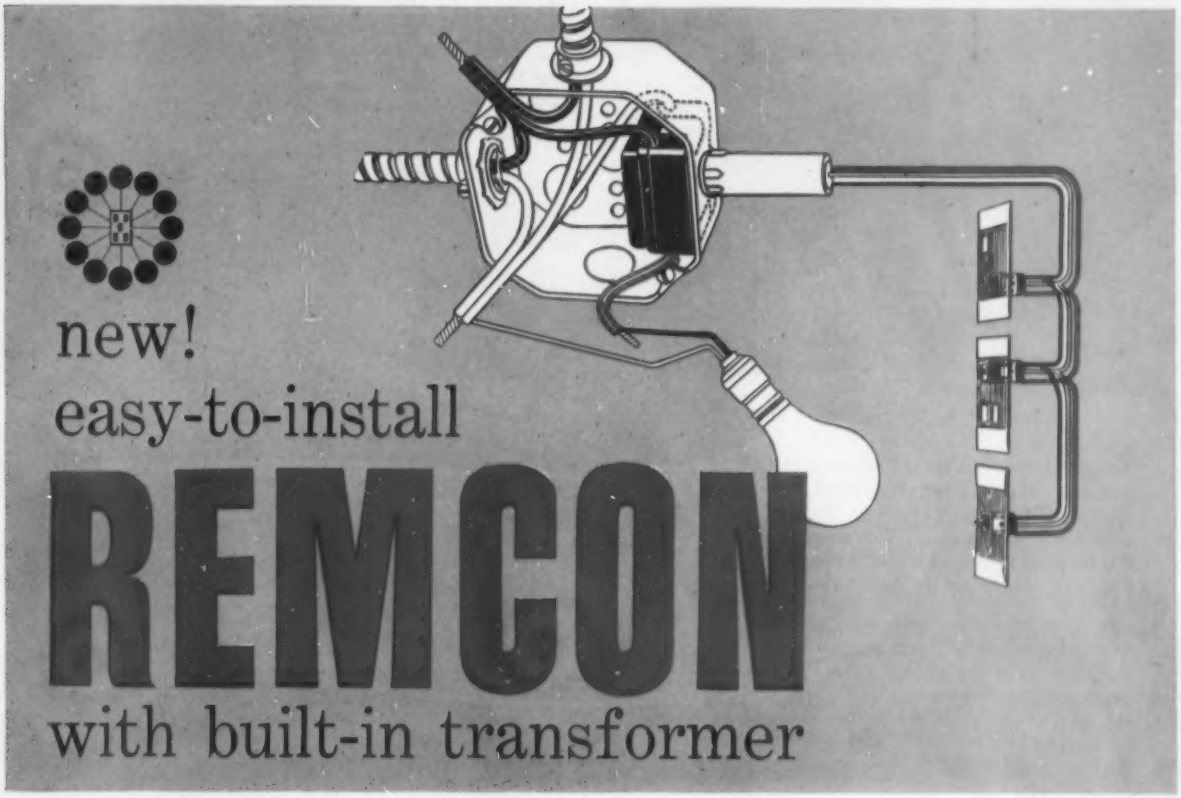

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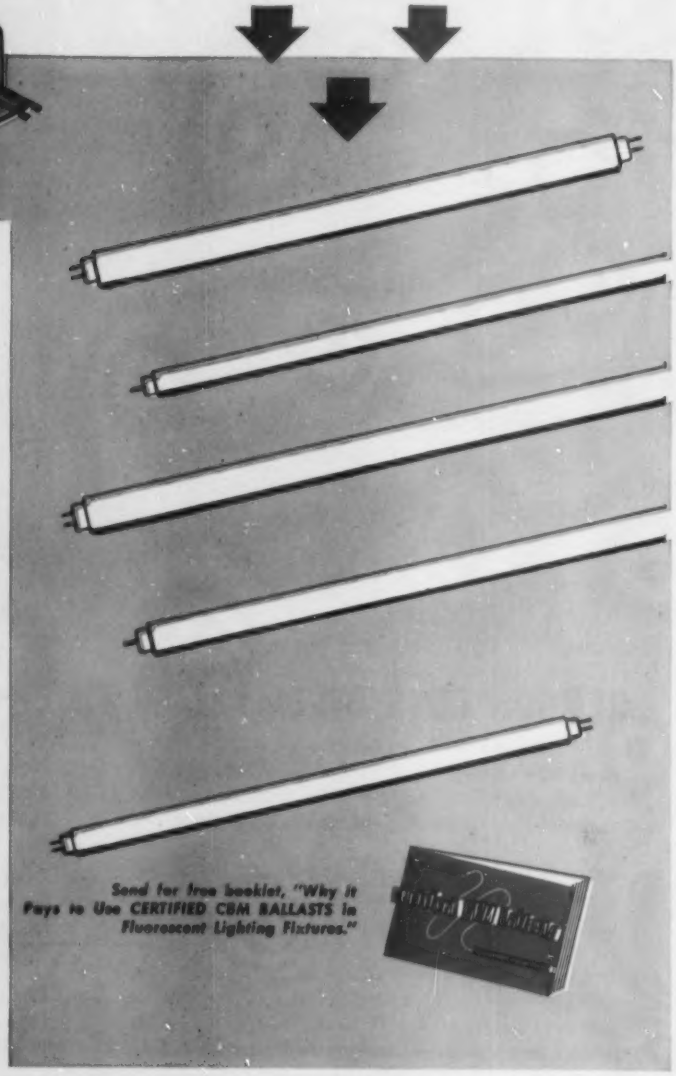

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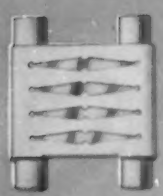

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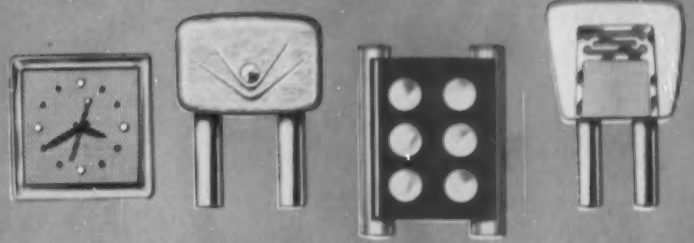

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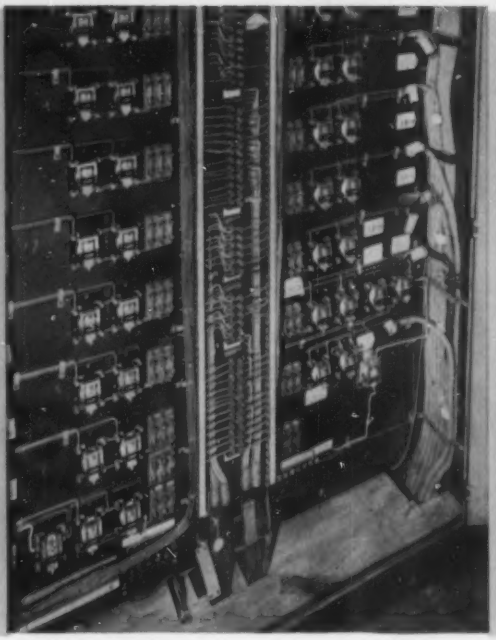

LEFT:
A substantial quantity of Rome Synthinol 901 was used at the General Petroleum plant, to connect plant areas with 16 motor control switch houses. The 900-acre plant produces a full range of petroleum products and many by-products.

RIGHT:
One of the underground distribution vaults at the General Petroleum Corporation refinery, Torrance, Calif. Cable tunnels go off to left and right. Control circuits are wired with Rome Synthinol 901.

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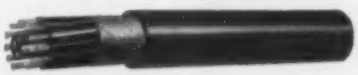

Rome Synthinol 901 insulation provides that extra margin of safety which costs so little in the long run. Its long-time dependability has made it the preference of such critical users as refineries, chemical processors, paper and steel mills.

If you have a control circuit problem, it will pay you to check on the economy and dependability of Rome Synthinol Control Cables. Rome engineers will gladly study your requirements. Write or phone your nearest Rome Cable office.

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Available Free to Readers of Electrical South upon Request

1048—Plug-in Strip
An illustrated catalog showing the complete "Plug-in" Strip line has recently been published by National Electric Products Corp., Pittsburgh, Pa. This eight-page illustrated brochure pictures the three and six foot standard lengths of the multi-outlet branch circuit assembly.

1086—Cable Connectors
Tomic Sales and Engineering Co., 4864 Woodward Ave., Detroit 1, Mich., now have available catalog sheets containing data on the complete line of their connectors, couplings, and cable connectors.

1088—Fittings and Fixtures
A 32-page illustrated catalog covering Killark fittings and fixtures is offered by Killark Electric Mfg. Co., Vandeventer and Easton Aves., St. Louis 13, Mo.

1092—Electrical Boxes
Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 12, Pa., offers a catalog of their complete line.

1130—Conduit Fittings
The latest completely illustrative catalog on their diversified line of conduit fittings is announced by the Atlantic Conduit Fittings Co., 589 Atlantic Ave., Boston 10, Mass.

1136—Space Heating Guide
Cavalier Corp., Chattanooga 2, Tenn., has prepared a Guide for Calculations on Electric Space Heating. It is based on study of several thousand installations of electric heat and is a handy reference for calculating electric heating requirements and estimating operating costs. The booklet contains discussion, charts, and floor plan examples.

1150—Fluorescent Fixtures
Light & Power Utilities Corp., 1035 Firestone Blvd., Memphis, Tenn., has printed a new catalog of fluorescent lighting fixtures. The new catalog is divided into six sections, each printed in its own distinctive colors. First section is devoted to "General Data" and details to L&P manufacturing.

1166—Electrical Fittings
A 40-page illustrated catalog and price list on the Gedney line. Shown and listed are conduit, threaded entrance, SEC, EMT and ground fittings, and box connectors for both armored and non-metallic cables. Copies are available from Gedney Electric Co., RKO Bldg., Radio City, New York 20, N. Y.

1178—Remote-Control Wiring
Bulletin 16-200 is a 36-page manual describing layout and installation of remote-control wiring, and is available from General Electric Co., Construction Materials Dept., Bridgeport 2, Conn. Advantages and explanation of the system are followed by illustrated installation procedure.

1184—Approved RHW Wire
Bulletin No. 1018 describing first Underwriters' Approved Type RHW Wire, developed to meet the new National Electrical Code standards, is available from Simplex Wire and Cable Co., 79 Sidney St., Cambridge 39, Mass.

1190—Electrical Fittings
Blackhawk Industries, Dubuque, Iowa, offers a complete catalog of electrical conduit and cable fittings. Also, a special publication giving detail drawings and instructions for installing service entrance masts on low or ranch type buildings.

1192—Wire Pulling Lubricant
Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 3812 150th St., Cleveland 11, Ohio.

1204—Conduit Fittings
Illustrated Catalog available upon request to Electrical Fittings Corp., Woodside, N. Y., or their nearest warehouse in your locality contains complete information on the company's electrical conduit fittings, conduit nipples, couplings, and elbows.

1214—General Catalog
General catalog of Royal Electric Co., Inc., Pawtucket, R. I., covering flexible service and lamp cords, cord sets, extensions, trouble lights, wiring devices and decorative Christmas lighting is available to wholesalers. Dealer catalogs may be secured from Royal distributors.

1218—Carbon Products
A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations characteristics and description of brush grades is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

ELECTRICAL SOUTH
806 Peachtree St., NE
Atlanta 8, Ga.

June, 1956

Gentlemen:

Please send me the bulletins and catalogs indicated.
(Print Plainly)

Name _____ **Title** _____

Company _____

Address _____

City & State _____

Circle numbers below. Bulletins and catalogs will be mailed promptly.

1048	1086	1088	1092	1130
1136	1150	1166	1178	1184
1190	1192	1204	1214	1218
1220	1224	1230	1238	1240
1242	1244	1248	1250	1254
1260	1262	1264	1266	1268
1270	1274	1276	1278	1280
1282	1284			

Laytex® Royal Master Electrical Cords

2½-ton trucks and 2,000-lb. spools run over U.S. Laytex Royal Master Portable Cords, without damaging them.

Sharp bits of hot steel in a grinding operation slash at U.S. Laytex Royal Master Portable Cords—without damage.

Workers have a habit of grabbing handtools by their electrical cords. This tool weighs 25 lbs., yet the U.S. Royal Master Cords have always held fast.

"They give us 3 times more usage!" says chief electrician of steel company.

In the 18 months since this plant in Massachusetts started using U.S. Laytex Royal Master Portable Cords on grinders and drills, *there has not been one cord failure* or need for replacement. "Formerly, we thought ourselves lucky if a cord lasted 6 months with an average of 2 repairs in that time. But U.S. Laytex Royal Master Cords can really take it," says the plant's chief electrician.

Run over by loaded lift trucks weighing 5600 pounds...

Run over by heavy reels and spools...

Bombarded by hot, jagged pieces of metal during grinding operations...

Yanked around when attached to heavy machine tools...

And yet U.S. Laytex Royal Master suffered no harm.

No wonder this steel fabricator is replacing its present cords with U.S. Laytex Royal Master Portable Cords.

You can obtain this great product at your "U.S." branch, your distributor, or write us at Rockefeller Center, New York 20, N.Y.

Electrical Wire & Cable Department

United States Rubber

1220—Stadium Lighting

The Pyle-National Co., 1334 N. Kostner Ave., Chicago, Ill., announces the availability of a new eight-page bulletin, No. 605, on stadium lighting, describing in detail floodlighting of a typical outdoor athletic arena stressing the importance of using fully enclosed floodlights.

1224—Electrical Equipment

The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog Con 15-0 and Bulletin W. C. B. 53-1, containing data on their lines of Safety Switches, Service Equipment, Distribution Panels and "E-Z-RED" Circuit Breakers.

1230—Compression Connectors

An illustrated 18-page bulletin (13A) describes Squeezon compression connectors for all overhead distribution connections from line wire to ground rod. Offered by James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., the bulletin also describes the mechanical and hydraulic installation tools required and tells where to use each.

1238—Selecting Fuses

A 12-page descriptive handbook "Fuseology" tells how to get safest, most dependable, trouble-free electrical protection from fuses. Contains useful information on selecting right size and type of fuses—how to stop needless blows—avoiding poor contact and other troubles. Issued by Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

1240—Catalog of Fixtures

Catalog No. 9 of Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley 10, Calif., available upon request, contains attractively drawn illustrations of fixtures and scale drawings of their dimensions, as well as descriptive information and suggested applications for each fixture in the Prescolite line. List prices of the fixtures in Catalog No. 9 is inserted as a separate sheet with each of the booklets.

1242—Distinctive Lighting Fixtures for the Home

Jay Lighting Manufacturing Company, Inc., 25 Quincy Street, Brooklyn 38, New York has available upon request a new six-page illustrated supplement featuring their fixtures for the home.

1244—New Electrical Fittings Catalog

Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, straps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

1248—Conductor Armor

A new catalog of Superformed Armor Rods, Lineguards, Patch Rods, and Tap Armor describing various uses and applications of these products on overhead conductors is offered by The Fanner Manufacturing Company, Brookside Park, Cleveland 9, Ohio.

1250—Electrical Enclosures

Catalog No. 5354 currently being offered to the trade by B & C Metal Stamping Co., 590 Means St., N. W., Atlanta, Ga., is a well-organized, 66-page manual giving complete descriptive information, prices, and specifications on all items in the B & C line of electrical enclosures. Copies are available free of charge to electrical contractors.

1254—Construction Anchors

"Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

1260—Lampholders

Multi Electric Manufacturing, Inc., 4223-43 W. Lake St., Chicago 24, Ill., has available copies of their Bulletin No. 555, which illustrates and describes the complete line of Multi Sparlites and accessories and fittings for these lampholders. Combination units are included.

1262—Fluorescent Fixtures

The new loose-leaf catalog recently issued by Southern Lighting Manufacturing Co., 501 Elwell St., Orlando, Fla., contains complete diagrams, specifications, and descriptions for all fluorescent fixtures which they manufacture. In addition to the information on commercial, industrial, and school fixtures, the catalog also lists hangers, troffers, troffer accessories, and incandescents which are available from the firm.

1264—Thiel Fasteners

Literature is now available on Thiel Easy Drive staples and other fasteners such as Hump Drive "Nail-Its," "Grip Type" 1-hole pipe straps, hangers, etc. Write to Thiel Tool and Engineering Co., 1417 N. Market St., St. Louis 6, Mo.

1266—Metal-Clad Switchgear

Detailed information on metal-clad switchgear is now available in two special bulletins, 7004-B and 7004-C. These booklets give descriptions, application data and specifications on units up to 15 kv and 500,000 kva interrupting capacity. Wire I-T-E Circuit Breaker Co., 19th and Hamilton St., Philadelphia 30, Pa.

1268—Lighting Fixtures

The Perfeclite Co., 1457 East 40th Street, Cleveland 3, Ohio, makes available the following literature: (1) Data Folder 54-B—4 pages of engineering information, prices and specifications on Plastic Indirect Concentric Ring Luminaires. (2) Data Folder EX-55-A—10 pages of information on Exit Units for all building locations. Complete engineering data and prices given. (3) Data Folder 56-A—information including prices and specifications on Ceiling Pan Fixtures and Vapor Proof Prismatic Exterior Fixtures.

1270—Aerial Ladders

J. H. Holan Corp., 4100 W. 150th St., Cleveland 11, Ohio, has just published a 4-page catalog on their Series 2200, Mechanical Ladder. They also have a new catalog on their Series 2100 All-Hydraulic Ladder.

1274—Space Heaters

A bulletin has been released by Ceilheat, Inc., 5215 Homberg Dr., Knoxville, Tenn., describing their line of wall unit space heaters, with specifications. Ceilheat's three types of radiant cable are also described.

1276—Attic Fans

A new four-page, two-color catalog (Bulletin 7514) describing the new Model CA Ventura attic fans for residential "comfort cooling" is now available from American Blower Corp., Detroit 32, Mich.

1278—Porcelain Insulators & Hi-Line Hardware

Knox Porcelain Corp., Knoxville 1, Tenn. has recently released catalogs containing complete information on their suspension, pin-type, spool and guy strain insulators as well as Hi-Line hardware and bushings.

1280—Electric Heating

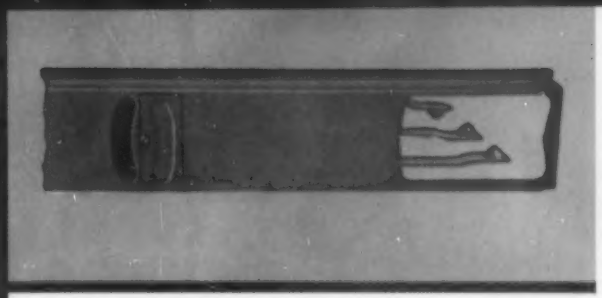
Electromode Division of Commercial Controls Corp., 45 Crouch St., Rochester, N. Y., has issued a new catalog listing their complete line of electric heaters, including bathroom, wall-type, portable, baseboard heating, radiant heating panels, various industrial units, and combinations. Also included in Catalog No. 31-K-3 are complete specifications and price list.

1282—Exit Lights

A four-page catalog providing illustrations and specifications for their complete line of exit lights has been released by Curtis Lighting Co., 6135 W. 65th St., Chicago 38, Ill. Types of mountings illustrated include recessed, end to wall, ceiling, direct wall, and pendant.

1284—Electric Radiant Heating

The design and installation of electric radiant heating is covered comprehensively in two publications just released by General Electric Co., 95 Hathaway St., Providence 7, R. I. Designers of heating systems will find valuable information in a 24-page Electric Radiant Heating Design Manual. A 36-page manual explains and illustrates how to install G-E Electric Radiant Heating in homes.



STANDARDIZED 10′ SECTIONS have 10 plug-in openings—5 on each side. Exclusive crescent-shaped openings insure proper insertion of plugs and accommodate plugs from 30-amp to 600-amp capacity.

PLUG-IN POWER INSTANTLY . . . BullDog bus plugs are equipped with reinforced fingers to engage bus bars for maximum positive pressure contact. Compact design and minimum weight insure ease of installation, full use of plug-in openings.

MORE SAFETY–
MORE SATISFACTION–
MORE SAVINGS

...WHEN YOU INSTALL BULLDOG PLUG-IN DUCT

Keeps pace with power needs today and tomorrow!

A sound investment—now and in the future! Installing BullDog Plug-In Duct for branch circuits provides a flexible distribution system to meet all immediate and future needs.

Plugs are designed exclusively for BullDog Plug-in Duct . . . offer safe, convenient tap-off and positive branch circuit protection. They mount on either side of the duct with ease, speed and safety—are so compact they permit maximum use of duct openings. Safety-engineered to insure correct polarization, the plugs *cannot* be inserted improperly.

Seven different, interchangeable plugs—Vacu-Break®, Fusible, Circuit Breaker, Capacitor, Transformer, Ground Detector, and Temperature Indicating—provide a type and size to meet every application.

These and other advantages make Plug-In Duct first in its field . . . add up to satisfaction and savings for you and your customers. See your BullDog field engineer or qualified distributor for details or write BullDog Electric Products Company, Detroit 32, Michigan. ©BEPCO

IF IT'S NEW...IF IT'S DIFFERENT...IF IT'S BETTER...IT'S **BULLDOG**

ELECTRIC PRODUCTS COMPANY

A Division of I-T-E Circuit Breaker Company

Export Division: 13 East 40th Street, New York 16, N. Y. • *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Road, Toronto 15, Ont.

CONSULT THE FOLLOWING SOUTHERN REPRESENTATIVES:

WILSON ELECTRICAL EQUIPMENT CO.
2930 Commerce St., P.O. Box 1725
Houston, Texas

WILSON ELECTRICAL EQUIPMENT CO.
101 E. Maple St.
San Antonio, Texas

STANDARD ELECTRIC MFG. CO.
2401 Federal St., P.O. Box 1138
Dallas 1, Texas

WALKER ELECTRICAL CO., INC.
125 Bennett St., N.W., P.O. Box 8, Sta. D
Atlanta, Georgia

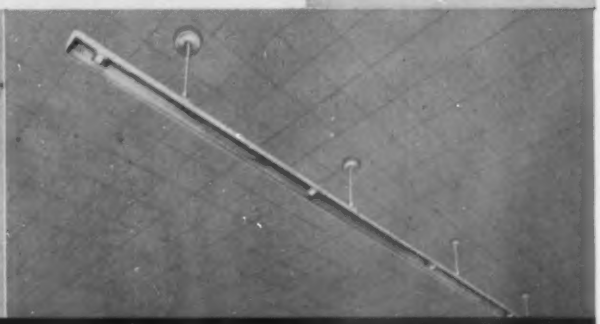
THE LIGHTS THAT GO IN WHEN THE PAINTERS GO OUT...

No On-Job Storage. No Paint-Spattered Fixtures. 50% Savings on installation costs.

Gibson ORTHO Fixtures need not be stored on the job where they're in the way of workmen and in danger of damage. Actually, Gibson ORTHO Fixtures can be delivered to the job the day before occupancy, because each fixture simply snaps into place in a matter of seconds, just as it comes from the box —sparkling clean, factory-fresh.

If you're interested in better lighting with savings of more than 50% on installation costs, then you really ought to know more about the Gibson ORTHO Line for industrial and commercial applications. Drop us a line. We'll send you the whole story.

1. WIRED ON THE FLOOR • A special channel (UNI-RACE) of telescoping 4' or 8' sections is assembled and wired on the floor, then lifted as a unit and mounted directly on joists, I-beams or stems. Saves hours of labor.



2. READY FOR THE FIXTURES • The UNI-RACE in place showing the built-in receptacles at 48" intervals. While the building is under construction, it will serve as a source of power for tools and temporary lighting.

3. SNAP—AND IT'S UP! • When the painters have left, the fixtures can be delivered to the building and snapped into place as fast as they are unboxed. Each fixture has a built-in plug which engages the receptacle in the UNI-RACE. Fixtures align themselves automatically.

4. VARIABLE SPACING • Fixtures may be installed in continuous rows or spaced at intervals of 4, 8, 12 or more feet. Units may be added, removed or rearranged any time without tools. Special "fill-in" sections close the UNI-RACE where no fixtures are mounted.

® AND PAT. PENDING

Gibson LIGHTING

GIBSON Manufacturing Co.

Houston, Texas | San Antonio, Texas | Dallas 1, Texas | Atlanta, Georgia

IN THIS UNDERGROUND FREEZER in an old stone quarry in Kansas City, Kansas, sections of G-E White conduit are subjected to a constant coating of ice. Because the conduit leads up to the surface through 70 feet of rock, it must withstand attack by moisture condensation and severe soil conditions.

EVEN IN UNDERGROUND FREEZER

G-E White resists corrosion

SULPHURIC ACID test typifies variety of lab tests which indicate G-E White's superior corrosion resistance to atmospheric conditions usually encountered in industrial areas.

Whether installed in the new Inland Cold Storage Company, Inc., giant underground freezer at minus 5 F, or tested in 100% humidity at 104 F temperature —G-E White rigid steel conduit proves that its corrosion resistance is unsurpassed.

Before this entirely new conduit was introduced commercially, it was tested for resistance to nearly every type of corrosive condition. It was immersed in sulphuric acid for nearly a week, in ammonium hydroxide for more than a month, and exposed to salt spray for 1000 hours at 95 F. These and many more laboratory tests proved the quality of the product.

Today, customers are benefitting from these tests and others. Underground and on rooftops, in water works and by the sea, in soil, steam, and smoke—in the toughest spots you can think of—G-E White is demonstrating its superior corrosion resistance in actual installations.

The reason for this remarkable performance is to be found in the smooth, ductile zinc coating on G-E White. It is the result of a special metallizing process of zinc-galvanizing. Metallizing bonds a controlled and non-flaking coating of pure zinc to the entire exterior surface of the conduit—threads and all. The inside is protected by a corrosion-resistant organic coating which produces a smooth, stable surface.

And there are many more advantages to G-E White—it bends easier, for example, saws easier, and threads easier than old-style conduit. So get the whole story: See your G-E Construction Materials distributor or write Section C64-624, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Selling more service equipment

by Randolph W. Reed, Jr.
Electrical Contractor
Washington, D. C.

Randolph W. Reed, Jr., left, Washington, D. C. contractor, looks over a shop-assembled 160-amp. service equipment and fuse panel with his electrician.

◆ A SETUP OF shop assembled service equipment mounted on panelboard and prepared by mass production methods for residential installation has increased production six-fold at our operation without increasing facilities.

Introduced by us after considerable study and experimentation, the setup comprises 22 standardized service equipments and fuse panels, each completely pre-fabricated, wires pre-cut, with load pre-figured and costs pre-priced, saving our mechanics hours of labor in the field. We are giving our customers an installation of top professional standards at lowered costs. Moreover, we can now provide immediate service, with appliances connected and operating within an hour.

The new approach to selling that our mass produced, bench assembled service equipment affords promises a tripled sales volume.

Let me review briefly the problems that gave impetus to this undertaking. Every contractor is only too familiar with the lack of top skilled labor sufficiently competent to plan a wiring job in the field. Every one of us has been only too conscious of the disproportionate costs of wiring as compared with the attractive low prices of fine, mass produced electrical appliances and equipment that even the low-income groups can now afford.

This discrepancy has troubled me as it has other contractors. Wasn't there some approach to the problem of bringing wiring costs more in line with the extraordinary achievements of manufacturers of assembly line products? How could we get around the lack of top skilled labor which, after all, was the heart of the matter?

As an admirer of Henry Ford, I told myself that if the automobile business built cars today the way we electrical contractors go about a wiring job, nobody could afford an automobile. Assembly line methods were the only answer.

Selected 22 services

We selected 22 services ranging from 60-ampere single phase through 200-ampere 3-phase as those most commonly used on residential jobs. By trial and error we selected and rejected, and finally standardized on materials and procedures for assembling each service. We compiled a list of the precise items, quantity, bins they were to be found in, and price of each item that went into each service.

For example, for a 160-ampere split bus type circuit breaker service equipment we listed 52 items; a 160-ampere service equipment and fuse panel called for 53 items, etc. One set of materials, one set of procedures defined and circumscribed each service. When completed, a service could appear only one way. Assembly could proceed in only one manner.

Any special requests a customer had, any deviations from a standard service equipment would have to fall into a different category of pricing and overhead. As Henry Ford said of his assembly line Model T car when he was asked for one in a different color, "You can have any color you want just so long as it is black." So with our standardized services.

To provide our shop mechanics with a guide to appearance and assembly procedure, we photographed closed and open views of each of the 22 services. With a notebook of each numbered and photographed service, its corresponding list of items and quantity in front of him, a young apprentice with less experience may now carry through an entire assembly that would be impossible for him in the field.

Stock was arranged in pre-cut lengths and sizes. Every individual item needed for a service was

Each of the 22 panel-mounted services is on display in the showroom. Here, Mr. Reed discusses with a customer a service under consideration.

In the shop, Mr. Reed points to the picture of a service and the list of required items beneath it that an electrician is about to assemble.

binned, labeled, located, identified in the list and ready for an assembly. For example, each of the five pieces of wire going into a 160-ampere split bus type circuit breaker service equipment is pre-cut, binned, identified, and ready for assembly. We have 40 different lengths, colors, and sizes of wire, individually pre-cut and sorted in numbered bins. Our shop mechanic does not have to stop for cutting, drilling holes, or fabricating.

Job man-hours reduced

Let me illustrate a few examples of savings. Time and labor savings in a shop assembled 160-ampere service over a field assembled job are almost incredible. It used to take us 12 to 16 man-hours to build a service equipment on the job; it is now assembled in the shop in one hour! It may take about four hours including transportation for one mechanic to install it at a residence.

One of the biggest time savers is cutting a 1½-inch knockout in a trough. It used to take approximately 30 minutes with a cutter in the field; the same knockout cut in the shop with an electric hole saw now takes 30 seconds.

Assembled equipment is mounted on pre-cut panelboard of ¾-inch plywood painted gray. In accordance with the Washington, D. C., Electrical Code requiring that a board be spaced ¾-inch from the wall to avoid moisture collection in the panel, we have designed a steel mounting bracket, to provide the needed space between panelboard and wall.

No field job can beat the top-notch professional appearance of our shop-assembled service equipment installations. That is because we leave nothing to chance. Every detail has been pre-calculated and provided for. No mechanic of ours has to grope around in a dark basement, grab for a random dusty board he happens to find on a shelf, or waste materials not cut to proper size. No time loss occurs running to a jobber for an item that is out, or back to the shop for a forgotten tool.

Furthermore, we run no risk of having a setup rejected in the field by the electrical inspector. Our 22 service equipment fuse panels and circuit breakers have all been approved by the inspector.

Less overhead costs

We believe we have solved one of the toughest angles of the skilled labor shortage. Our approach does not require as highly skilled labor in the installation of equipment as would be necessary if an electrician had to do an assembly on the job, planning details himself. All his thinking has been done for him. Under our new setup a mechanic, his helper, and one truck can do as many service changes in a day that formerly required six electricians, six helpers, and six trucks. Besides, when an apprentice carries out assembly jobs in the shop without a truck (as against a mechanic working at a home with a truck), we are saving the $5,000 in overhead put into one of our fully equipped trucks.

Office savings are incalculable because every job is pre-priced and loads pre-figured. Formerly, each of the 50 items going into a 160-ampere service would have to be individually priced and extended. Now there is one price per service installation. Checking purchase orders against a master price sheet, our bookkeeper records and notes price changes. Steep changes only would affect the pricing of our 22 standardized service equipments.

Every contractor is familiar with the great amount of detail required for each job in computing load. In accordance with the Washington, D. C., Electrical Code, we are required to submit a pre-figured statement detailing our

(Continued on page 110)

A city counter, receiving and shipping department were built in the basement of a next-door building bought and remodeled by Tennessee Armature and Electric Company, Knoxville, for drive-in service. The drive-in, at the side of the counter, enables a car or truck to get fast, efficient service.

Drive-in service ends bottleneck

by Warner Ogden

◆ A TIME-SAVER service idea has ended parking worries and has increased business at Tennessee Armature and Electric Co., 312 West Jackson Avenue, Knoxville.

For nearly 40 years the company has done a wide business in the maintenance of electric motors and equipment, as well as electrical contracting work.

The location is in the downtown business section, where parking has been a growing problem.

Some customers bringing in motors or other equipment for servicing had difficulty in parking. They had reluctantly turned and gone elsewhere with their business. It meant a loss of business to Tennessee Armature.

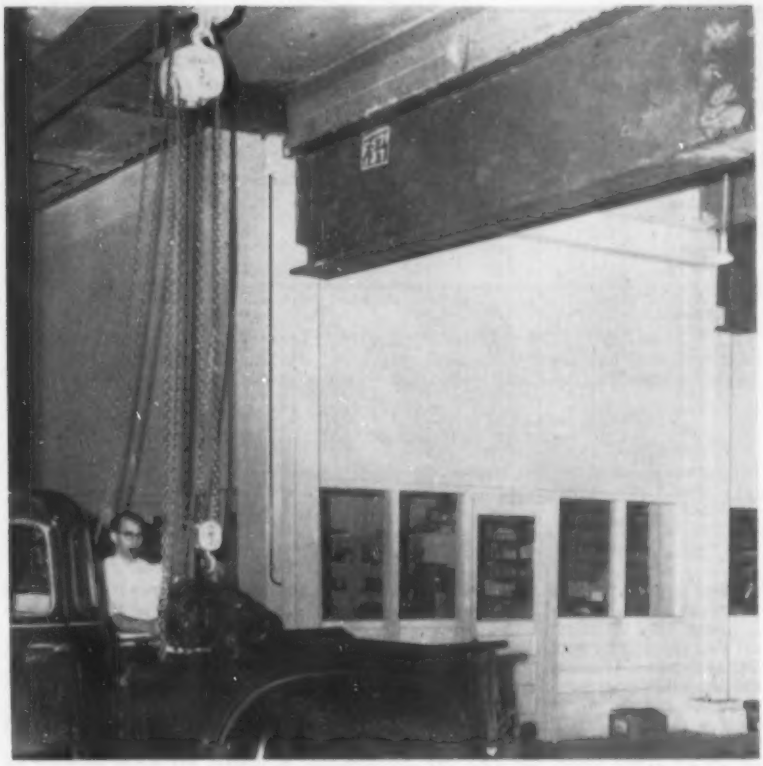
Parking situation

"The traffic and parking situation had reached the point where we were just unable to cope with it," explained W. G. Hoffman, president. "There was such a bottleneck, especially in the receiving and dispersing of motors, that we either had to move out and seek a new location or try to buy the adjoining property, which had not been for sale for years.

"But finally the estate which owned the adjoining building agreed to consider an offer which we made and the deal was closed."

The three-story next-door building was remodeled for drive-in service. The building had previously been used for a garage. It had ramps leading from the street to the second floor and one from the second to the third floor.

Ramps were removed from the second to the third floor. A new concrete ramp was built from the street to the basement level. Six tall columns were also taken out and heavy structural steel was used for reinforcing, so that cars and trucks would have space in which to turn around and drive out.



At top, W. G. Hoffman, president of Tennessee Armature, one of the leading electrical men in the South. At bottom, A. D. Irving and C. D. Van Hoosier look over a "product-of-the-month" display.

A three-ton electric hoist (one of three on a rail above) lifts a motor from a truck which has come down into the basement on the new concrete ramp from the street level. No time is lost. The truck can easily turn around and go out. The motor is quickly carried into the shops of the adjoining building for servicing. Tennessee Armature has received much favorable comment on the new facilities.

A city counter was built in the basement, so that a car or truck could drive up beside it and get quick service.

Trucks carrying heavy equipment can drive right under new electric hoists for quick and easy unloading or loading. An overhead rail allows the hoist to carry the motor into the shop next door for processing in the proper department.

The second floor of the new building is for off-street customer parking. A concrete ramp was built up to it and as a car reaches the second floor an electric eye rings a bell. Customers who expect to be in the plant for some time, or who do not have equipment to be unloaded, are invited in ads to make use of the new parking area.

A new showroom was also built so that persons using either the ramp into the basement or up to the second floor could see the displays through the glass sides and front. These displays show motors, parts, controls and rewinding service.

Business improves

"This drive-in service has helped business," said Mr. Hoffman, an electrical leader in the South, whose many honors include the district governorship of the National Electrical Contractors' Association.

"We have had much favorable comment from people who use the new facilities. It has expedited service and that is something which is necessary these days. This is the only drive-in service of this kind of which I know.

"We have various services. Fractional motors are taken in through a department adjoining the city counter. They are put on an electric elevator and taken up to the fractional horsepower department on the second floor. A customer bringing in a fractional horsepower motor is able to wait for a few minutes and get a complete report on repairs necessary, cost, and delivery time. This is done through an intercommunicating telephone system from the city counter to the fractional horsepower department. If the job is a minor repair and the customer is urgently in need of his motor, repairs can be made at once, if he is willing to wait a reasonable time.

"The larger three-phase and d-c motors are unloaded from the truck by an electric hoist that travels on an I-beam and are shunted through an opening into the old original building where the three-phase motor department is

(Continued on page 111)

Table 9—Relative costs of conductor insulations

This study compares the installed cost (including conduit) for the wire insulations commonly used in textile mills. Types AVA and AVB have been added for further comparison. Costs are based on 3-wire 3-phase circuits, in exposed conduits fastened to steel at a 16' working height.

Wire size	Relative cost per ampere-foot						
	R-TW	RW	RH	VC	RHW-RR	AVA	AVB
#14	207	212	212		235	144	129
#12	165	168	168		185	127	117
#10	135	139	139		152	105	108
#8	112	114	102		118	89	95
#6	117	120	102	108	112	91	97
#4	122	124	102	106	111	102	106
#2	100	103	85	92	94	94	117
#1	107	110	94	97	103	93	104
1/0	124	128	107	113	111	106	119
2/0	117	119	99	101	105	100	107
4/0	124	129	109	111	115	103	111
250	122	129	109	108	116	102	108
300	119	127	107	106	116	101	106
350	130	138	115	112	124	99	109
500	126	134	112	110	121	98	103
750	139	150	125	124	131	103	113
1000	159	169	141	131	144	107	119

(1) For sizes #14 - #8 and load currents up to 40 amperes, Types R or TW are the most economical of the common insulations. The installed cost of both types is practically identical.
(2) For sizes #6 - 300M and load currents from 41 - 300 amperes, Types RH or VC are the most economical of the common insulations. Throughout this range, the installed cost per foot for any conductor size will favor RH. However, because of higher current ratings, VC will sometimes cost less per ampere-foot.
(3) For sizes over 300M and load current over 300 aperes, consideration should be given to paralleling conductors. See Figure 5.3.
(4) Of all types listed, the cost per ampere-foot is lowest for AVA because of higher current ratings permitted by the N.E.C. Where circuit loads can utilize these ratings to advantage, Type AVA will be the most economical insulation of the entire group studied. Use of AVA and AVB is restricted by the N.E.C. to Dry Locations.
(5) Service conditions or other factors may justify the use of premium grades of insulation at a higher installed cost.

Table 10—Minimum standards for wire and conduit

Architect-Engineers usually specify a minimum size of conduit, and a minimum size and grade of conductor. The table below shows the relative installed costs per foot for several combinations of conduit and wire which might be so specified. In textile mill wiring, 1/3 to 2/3 of the power branch circuits will often fall into the minimum category.

Conduit	Wire	Relative cost		
		R/TW	RH	RR
½"	#14	95	98	109
½"	#12	100	103	116
¾"	#12	118	120	131
¾"	#10	126	129	142

Note: For the hypothetical job, the maximum variation in this item could produce a 12% difference in the low-voltage distribution system cost, or a 5% difference in the over-all electrical budget.

Table 11—Allowable voltage drop and power loss

This study shows the lengths of circuit which will limit voltage drop to 2% for branch circuits and 3% for feeders under the following conditions: 600 volts, 3-phase, 3-wire circuits; 80% power factor; distributed load=80% of NEC conductor rating; drop calculated to circuit load center.

Circuit		Permissable length-feet			
Type	Size	R/RW/TW	RH	VC	AVA
Typical branch	#12 - #8	330	330	220	190
Light feeder	#6 - #1	690	580	540	475
Heavy feeder	#0-500M	1000	830	800	650

(1) Voltage drop should not be a determining factor at 600 volts unless circuit lengths are excessive or loads exceed code ratings.
(2) Under these same conditions, and on the basis of low energy rates paid by textile mills, power loss can generally be ignored in design calculations.
(3) These conclusions would not necessarily apply at lower voltages.

Cost factors

Part 3

By Howard R. Pancoast

President, Bryant Electric Co.
High Point, N. C.

◆ DESIGN-CONTROLLED cost factors, as the name implies, include those which are governed largely by the designer's decisions in preparing job plans and specifications. Some of these are more or less fixed by custom, such as the use of 600-volt feeders in our Carolina textile mills. Others have no direct bearing on the low-voltage distribution system, and therefore will not be mentioned.

A wide range of items still remains to be considered, and they allow the designer ample play for using his judgment and ingenuity. Some of them are: choice of wiring method such as wire and conduit, busway, pre-assembled cables, underfloor duct, and others; allowable voltage drop, power loss, demand and load factors; minimum sizes of conduit and wire, and the type of wire insulation; locating of substations and panelboards for minimum circuit length; and the general quality and standardization of materials and equipment which will be used.

As is true with the contractor-controlled costs, some of the items in this grouping cannot be compared quantitively. Also, in making his decisions, the designer must strike a fair balance between cost and service. These decisions will automatically establish the quality and cost level of the job. They will therefore have a greater effect on actual over-all costs than any variation which the contractor can legitimately introduce. Comparative cost information is presented on these design-controlled factors in Tables 9 to 13.

Business-controlled cost factors include those which are primarily established by management or operating policies rather than by purely engineering judgment.

# of textile mill low-voltage distribution

They may be loosely classified as either physical or fiscal. In some cases, the controlling policies may require the sacrifice of quality or desirable engineering features to meet an arbitrary cost figure. On the other hand, they may require that certain things be done regardless of electrical cost. Even a casual study will demonstrate that the business-controlled factors can have a far greater impact on the cost and quality of the electrical installation than those controlled either by the contractor or designer.

Physical factors involve decisions about the arrangement, appearance, and operation of the plant. The arrangement of the plant in turn will govern such factors as: machinery layout and load density, the space which can be made available for electrical equipment, and the use of special tunnels, basements, platforms, or other structural or building features which may be required for the electrical system. The desired appearance of the new plant will determine such items as street lighting, underground services, tile walls, acoustical tile ceilings, recessed lighting fixtures, and concealed wiring. Operating decisions will largely determine such questions as group vs. unit drive, control and interlock systems, the interruptibility which can be tolerated, and provisions required for future growth and expansion. No attempt has been made to evaluate any of these items, but their economic effect is readily apparent.

Fiscal factors, in-so-far as they have a direct bearing on the economics of electrical installations, involve policies and procedures which will be followed in the negotiating and awarding of the electrical contract. The magnitude, complexity, and importance of the electrical installation in the modern textile mill dictate that the selection of the contractor should not be left to chance. Wise managements will exercise the firmest control and the most careful judg-

(Continued on page 110)

Table 12-A—Wiring methods; VCI cable

This study compares the installed cost of 3-conductor Type VCI pre-assembled cable (varnish cambric insulation and interlock armor over-all) with Type VC and RH in conduit.

Conductor Size	Relative cost per ampere-foot		
	VCI	VC	RH
4	116	106	102
2	101	92	85
1	93	97	94
0	101	113	107
2/0	92	101	99
3/0	96	98	95
4/0	94	111	109
250	93	108	109
350	93	112	115
500	90	110	112
750	102	124	125

Table 12-B—Wiring methods; busway plug-in duct

On the basis of relative cost per ampere-foot, plug-in duct is not competitive with wire and conduit circuits. However, the busway also includes a part of the cost of power panels and branch circuits. When all of these items are considered together, plug-in duct may be less expensive than wire and conduit, depending on the load density. The following comparison is based on a typical layout.

Conduit system	Relative cost		Busway system
Feeder circuit	45	71	Duct only
Power panel	36	28	Plug-ins
Branch circuits	19	8	Branch circuits
Total	100	105	Total

Note: In considering busways, weight should be given to flexibility for future additions or changes, and to salvage value when removed or replaced.

Table 13 — Miscellaneous items

No cost study has been made for these items, but they will generally merit consideration by the designer in specifying the most economical power distribution system:

(1) Load center distribution

Locating substations, transformers, switchgear, and panelboards at or near the center of the loads they serve will usually reduce cost and improve voltage regulation by shortening the length of sub-feeders and branch circuits.

Note: Stanier's "Plant Engineering Handbook" states that the total conductor requirements are reduced about 15 to 40 per cent when substations are located at the center of the load instead of outside the process area.

(2) Standardization

One way in which the designer can help the contractor to achieve the lowest cost of installation is by specifying the minimum number of sizes and types of conduit, wire, transformers, panelboards, starters, circuit breakers, fixtures, and etc. This will reduce both paper work and physical effort in purchasing, expediting, handling, storing, and installing the materials. Possible cost savings may be estimated conservatively at 1% to 3% of job labor cost.

(3) Other wiring methods

Pre-assembled aerial cables
Fiber and Transite underground ducts: standard wall in concrete; heavy wall—no encasement.
Wiring trays: T. J. Cope Company and similar.
Underfloor ducts: power branch circuits.

Contractors meet in Charleston

◆ APPROXIMATELY 150 of the Southeast's most important electrical contractors attended the annual meeting of the Third District of the National Electrical Contractors Association at the Fort Sumter Hotel in Charleston, S. C., May 9, 10, and 11.

Large delegations were sent by the following chapters comprising District III: Birmingham, Central Alabama, Gulf Coast, North Florida, South Florida, Atlanta, South Georgia, Southeastern Line Constructors, Central Mississippi, Carolinas, Chattanooga, Knoxville, Memphis, Nashville and Virginia.

The well organized speaker panel included such prominent men in the field of electricity as Oliver F. Burnett, of Chicago, president of the National Electrical Contractors Association; Paul M. Geary, of Washington, executive vice-president, and Howard Farley, also of Washington, a member of the NECA staff as public relations and advertising chief.

With the Carolinas Chapter as host and John Seabrook, of Charleston, president of the Southeastern Line Constructors Chapter, in charge of the program and local arrangements, the convention went smoothly through three days of business sessions, panel discussions, and social events for both members and their wives and guests.

Photographed at NECA's Region 3 annual meeting, held in Charleston, S. C., recently, left to right, are President Oliver F. Burnett, of Chicago; Vice-President Paul M. Geary, of Washington, D. C.; and Field Director C. S. Thurber, who maintains headquarters in Atlanta.

Carl Teal presides

The meeting began late May 9 with registration of arriving delegates at the hotel, located on Charleston's Famous Battery. There they were greeted by Carl Teal, of Birmingham, vice-president for the Third District.

The board of governors of the district then held a closed session to discuss plans for the convention and to discuss work for the coming year.

The annual Governor's Breakfast opened the activities on the second day, and Mr. Teal presided. Following the breakfast, late arrivals were registered.

The first formal business session got underway with an address of welcome delivered by Charleston's Mayor William McG. Morrison, who told the visiting contactors that he and the city were proud that the association had chosen Charleston as the convention site and immediately issued an invitation to the group to make it an annual habit to meet in Charleston.

Mr. Seabrook then introduced Mr. Teal who presided at the session, as he did at all future sessions. Mr. Teal in turn introduced Harold A. Petit, of Charleston, vice-president and Charleston Division Manager of the South Carolina Electric and Gas Co., the first speaker.

He addressed the group on "The Utilities Program of Tomorrow." In approaching the subject, he made certain predictions and said, he thought, from a national standpoint there would be a continuation of heavy defense spending but no "hot wars," there would be stability of prices, and that we would not experience the much talked about "runaway inflation." He saw no great change in tax structure of the country.

He stated that these predictions and also the ones concerned with the public utility business were predicted on the assumption that the American people would place in power, national administrations which would follow a road slightly right of center.

Kwh use up sharply

He pointed out that the usual yardstick for measuring public utility business was the kilowatt hours use per residential customer per year and to indicate the trend, he said that the national average in 1930 was 547 kwh; in 1955, 2,700 kwh; and that in 1970 if the trend continues it would amount to 7,700 kwh. He said he considered this estimate a conservative one, for the use per residential customer in the Charleston Division of the S. C. Electric & Gas Company was approaching 4,000 kwh per year.

He touched on electrical living

Random views made at Third District, NECA, annual banquet in Charleston, S. C.

features which are new to everyday use but available and are now being used in a limited way, such as air-cooling and heating for the entire house, automatic switches for house lighting controlled by the amount of light, colored television throughout the house and, in addition, television communication within the house, permitting the mother to supervise the play of her children, and fingertip controls which would cause walls to disappear and the living room and the garden to become one. The home of 1975 would have all these and many more electrical features presently unknown.

Mr. Petit said that this increase in residential use, along with the increase in population, which is estimated to be in 1970 as high as 200 million, would present a real challenge, not only to the public utilities but to manufacturers of electrical equipment, builders of distribution and transmission lines, the wiring of homes, and the manufacturers of electrical appliances.

Distribution major item

He stated that as he viewed it, the principal problem would be in the redesigning of distribution lines. He estimated that as a national average, 46% of the utility investment was in these lines.

He said that these increased requirements would be felt first in the Southeast, and to substantiate this statement he quoted the Federal Power Commission, which stated that the residential load in the Southeast would grow 465 per cent between now and 1980 as compared with estimated national average growth of 316 per cent.

New planning, new design, and new construction have been the immediate concern of the public utilities. He said that during the past five years public utilities spent approximately 20 billion dollars, and that during the next 15 years it is estimated that they will need approximately 75 billion dollars.

He stated that during the past year his company had spent over 15 million dollars on new construction, and that during the next three years they would spend almost 75 million dollars. He further stated that the general policy of public utilities was to keep ten years in advance of anticipated demands.

He mentioned the vast increase in generating capacity of his company, stating that another unit had been added to the plant of the Savannah River which brought the capacity to 250,000 kw; that ground had been broken for Plant McMeekin at Irmo, S. C., which is designed to ultimately produce 600,000 kw; and that in the planning board stage was one for Bushy Park which would have an ultimate capacity of 500,000 kw.

Mr. Petit stated that there was an economic revolution going on in this country and that the odds were very much in favor of the Southeast, and that he felt with the pooling of abilities and efforts of the entire electrical industry, we could and would take advantage of the opportunity to further develop this part of the country.

A report on the progress of the Third District was presented by Charles S. Thurber, of Atlanta, regional director who traced the progress in obtaining new members.

Mr. Thurber cited the need for obtaining additional qualified members in the states of the district and urged the membership to aid in obtaining them.

The National Electrical Contractors Association's Program for Line Constructors was presented by Charles Moseley, of Charlotte.

Following a luncheon in the hotel, the convention was reconvened to hear an address by President Burnett who spoke at length on "NECA's Service to the Electrical Contracting Industry."

Mr. Burnett, who illustrated his address by the use of slides, listed these services under five headings.

NECA member services

These were (1) public relations service; (2) marketing service; (3) labor relations service; (4) technical and training service; and (5) field services.

Under public relations, the president told of NECA's aid in obtaining fair and just legislation as it affects the electrical contracting industry. This included liaison with government agencies specifically interested in electrical contracting and with related agencies.

He told of the organization's monthly magazine and how it is used to acquaint members with the latest advances in the industry and with steps being taken by the national organization to improve its services. He also touched here on the weekly news letter mailed to members by NECA.

NECA, the president said, has full and capable representation on business and industry councils and has done much to promote fair trade practices in the industry. All these, he said, were being accomplished by the public relations service.

Under marketing services, Mr. Burnett classed market research as a most important chore of the NECA work. But he also classed as highly important, institutional advertising, personal contacts, relations with suppliers, architects, engineers and builders, and the formation and carrying through of the adequate wiring program.

Labor relations improved

Mr. Burnett said that its labor relations service has been instrumental in solving thousands of small disputes between the contractors and workers. Its labor relations group has been recognized by both labor, management, and the government.

Mr. Burnett said not once in 36 years has a finding of NECA's labor relations group been ignored in the few cases where labor disputes have been turned over to mediation agencies.

Mr. Burnett pointed to the organization's apprenticeship and training program as one that is doing much to provide a continuing flow of trained personnel for the electrical contracting industry. A national plan for settlement of trade jurisdictional disputes is also a feature of the labor relations service of NECA, he said. It has also worked out a "uniform and reasonable pension plan — not a hodge-podge," Mr. Burnett added.

Under technical and training services, Mr. Burnett listed these benefits for contractors: codes, inspections and licensing; industry statistics available to members; adequate wiring standards; the NECA Building Research Institute; labor and operating cost data and manuals; management and technical personnel training courses to meet expanding need for trained personnel; improved management procedures including accounting, estimating, job management, sales engineering and business management, and business forms.

Field service has promoted many conventions and meetings. "The number of these conventions are increasing," Mr. Burnett said. "They now have become a necessity from both a business and social standpoint."

He traced the field service through the local chapter to the

(Continued on page 108)

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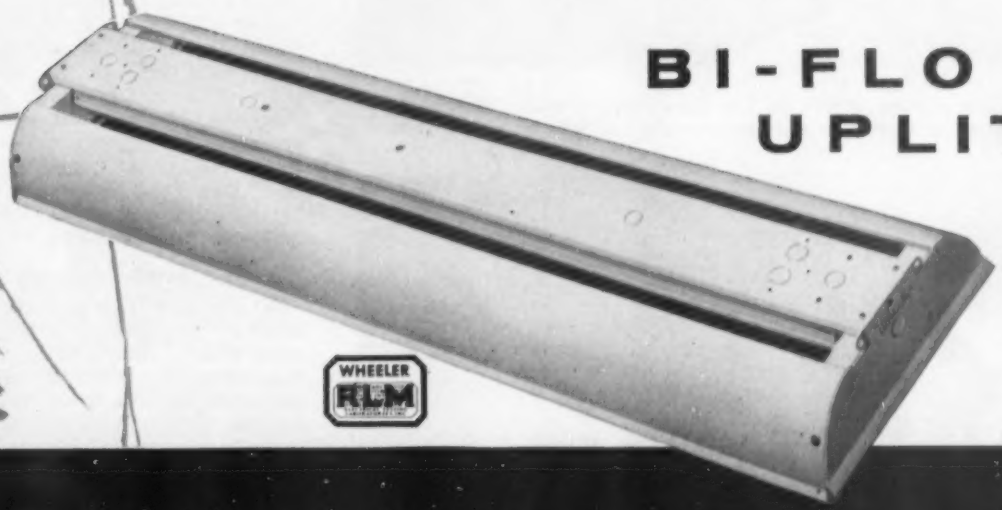

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Heat pump installation in hatchery

by J. D. Brown
Electrical Development Board
Tennessee Valley Authority

Curtis Allison checks gauges on the big incubator where thousands of eggs are hatched. Incubator temperature stays at 99°, humidity at 86%.

Mr. Allison inspects filter on one of the new electric heat pumps that will provide year-round heating and air-conditioning for hatchery.

◆ PIONEERING in the hatchery business is being accomplished in the small Alabama community of Bridgeport by Curtis Allison—and he is saving a good bit of money at the same time.

Allison Hatchery, which sends out 75,000 baby chicks a week, is believed to be the first hatchery in the nation to install electric heat pumps for year 'round air conditioning.

Allison has two 5-horsepower machines which do a double job—summer cooling and winter heating.

These heat pumps operate on the "reverse cycle" principle. During summer they work something like the household refrigerator—taking heat out of the building's air and sending it outside the building. In cold weather, the cooling cycle is simply (and automatically) reversed — the heat pumps bringing in the heat that is in the outside air to help to do the job of heating the building.

And Allison has some mighty good reasons for pioneering the use of heat pumps in the hatchery business. He had been considering resistance electric heat and conventional electric air conditioning. But he put in heat pumps instead—and thereby became the first hatchery operator in the nation to do so—for these reasons:

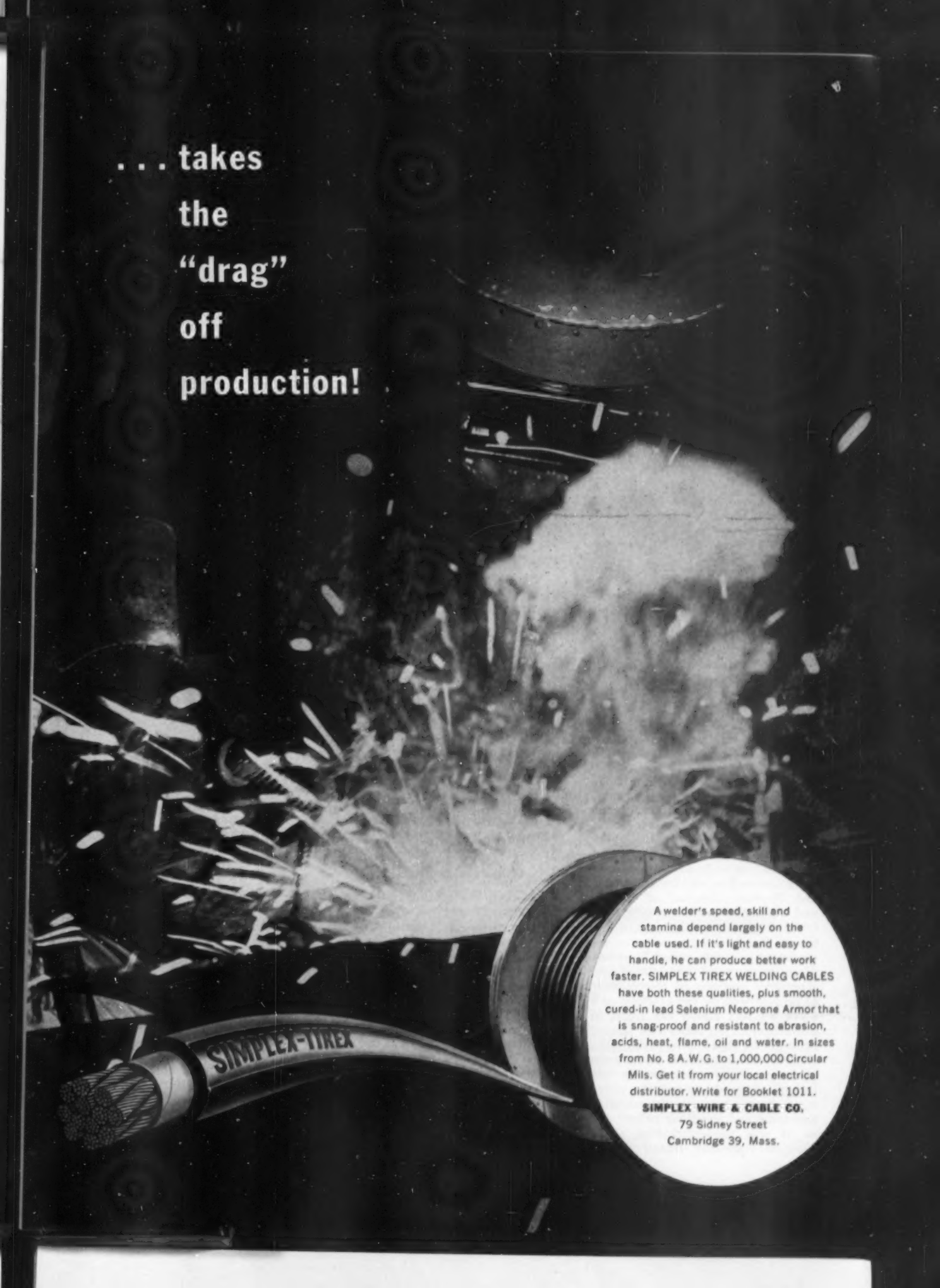
Heat pump advantages

(1) Heat pumps will cut his heating costs in half (or perhaps even more), compared with resistance electric heat. By using the heat that the outside air contains, the heat pump drastically reduces the amount of electricity needed to provide heat.

And this means less wiring, too, since Allison will be using just two 5-horsepower machines instead of an estimated 60 kilowatts of resistance electric heat. With the heat pumps, Allison uses smaller wire—and a 200-ampere switch box instead of a 400-ampere box that would be needed for the 60 kw of resistance heat.

(2) For summer air conditioning, the heat pumps use just as much

(Continued on page 108)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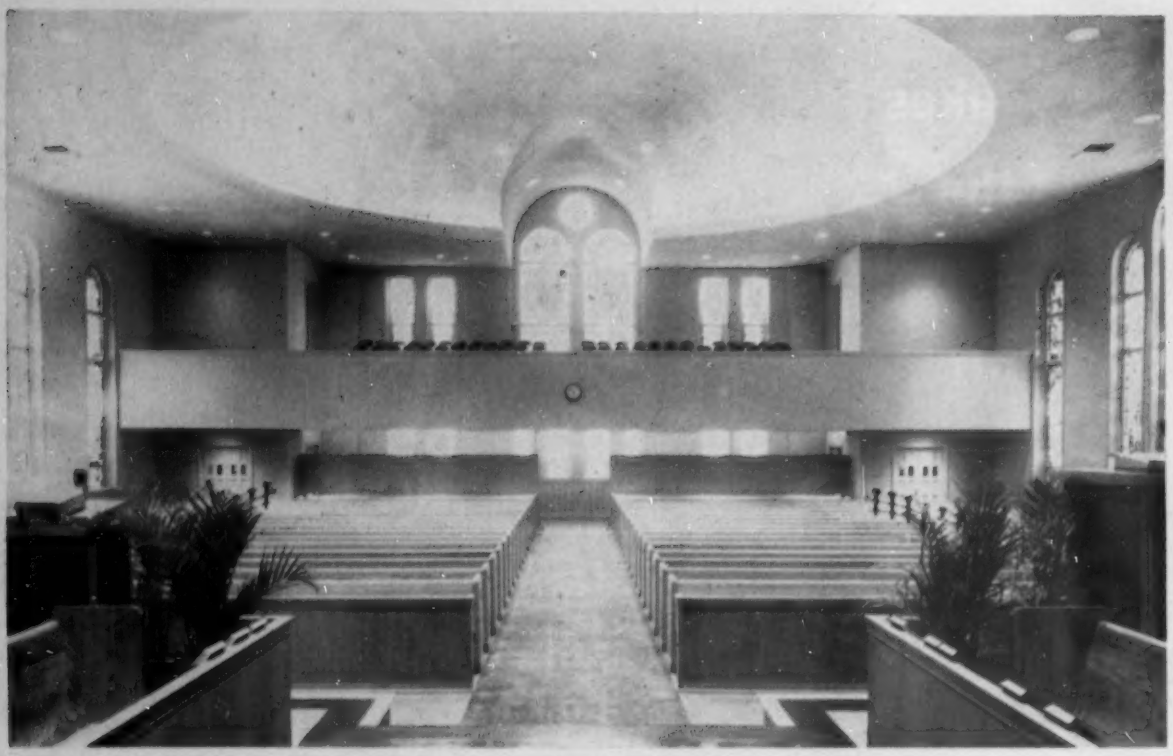

New lighting system for the 100-year old Dexter Avenue Methodist Church, Montgomery, Ala., combines trough lighting and direct down-lighting to prevent "too open light" at any point.

Innovations in church lighting

by Robert A. Latimer

◆ MANY INNOVATIONS in church lighting have been incorporated in the new lighting system recently completed in the Dexter Avenue Methodist Church, Montgomery, Ala., by Dixie Electric Co., electrical contractors of the same city.

When originally called into consultation on the job, David Mosely and Herman Bowles, of Mosely and Yarbrough, Montgomery electrical engineering firm, were dubious. Specifications for the remodeling program called for complete gutting of the nave and sanctuary sections of the church, to be followed by the erection of a dome 60 feet above the floor, in the center of an otherwise square ceiling. In the nave area, the church elders insisted upon even intensity of light, despite the "altitude" of the dome and the varying distances between the curve of the dome and the floor below. Also, it was requested that Dixie Electric Company install "mood lighting," which permits the pastor to dramatize the theme of his sermons with a variety of colors at the rostrum and pulpit area.

Complete remodeling

However, the lighting considerations were no more alarming than the over-all architectural remodeling which had been undertaken by the 100-year-old church. Anxious to retain as much of the original atmosphere of the building as possible, the congregation and directorate of the church had called for such unusual steps as raising of the building, and the installation of a new foundation under the original walls, installation of new steel framework in time-weakened sections of the building, etc. In the face of such heroic undertakings, the Alabama electrical contractor resolved to work out the lighting system without adding more woes to the over-all church rejuvenation job.

The lighting system as eventually developed called for several unusual aspects. First, as mentioned, it was settled that a smooth, over-all average of 10 footcandles would be provided in the congregational area, plus the sanctuary, with the entire overhead incandescent system readily increased or dimmed in intensity by means of a remotely located, motor-driven dimmer switch. On the elevated platform on which are located the organist, the pastor's pulpit, choir facilities, and various pieces of functional furniture, it was likewise decided to install gelatine-lensed spot lights in a variety of color combinations, controllable from the ulpit to develop the "mood lighting" specified.

With the Mosely and Yarbrough

(Continued on page 106)

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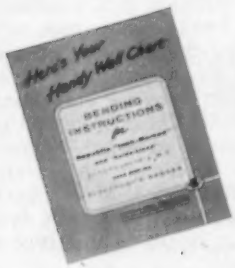

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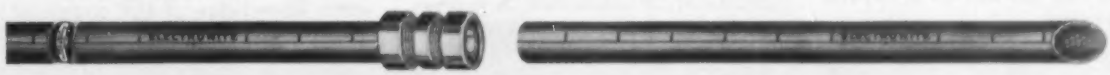

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Maintenance engineers' notebook

Electrical measuring instruments

How to select and apply electrical measuring instruments in textile mill maintenance work

By Robert S. White, Chief Electrical Engineer, Universal Winding Co., Providence, R. I.

◆ THERE ARE THREE general fields of use for electrical instruments. Development is the first field—where new products are being engineered. Efficiency, economy and life are tested prior to manufacture. Second is checking the performance of equipment, products or processes. Trouble shooting, of course, fills the number three slot. We are primarily concerned in this article with the areas of checking and trouble shooting.

Checking includes maintenance where routine tests are made to determine that the loads on mains and feeders are not too great. Switchboard monitoring of generating and distribution equipment, ground detection using polyphase electrostatic ground detectors or triplex voltmeters, batch weighing and monitoring and production of stretch yarns, printed fabrics, etc., all fall in the checking category.

Instruments employed in checking service need not be connected to a circuit at all times. Economy may dictate that one ammeter and one voltmeter suffice to monitor all phases of a certain polyphase system necessitating switching the instruments from phase to phase. A "clamp-on" type of ammeter may be used at irregular intervals to check the loads on several motors in a mill. If the checking or process monitoring instruments are properly selected, permanently connected, carefully maintained and accurately read, the information available from them can be invaluable to quality control and continuity of production. Any deviation from a familiar normal or average value for a particular function is a fore-warning of trouble brewing and steps can be quickly taken to determine the reason for the unusual indications.

Choosing test instruments

Instrumentation in the trouble shooting field can present very real problems. The Plant Engineer, assuming that there is a place for them in his budget, must determine the best kind and the quantity of instruments needed by his electrical people. His choices are governed by the kinds of power, ratings of largest and smallest loads, and the characteristics of these loads. Naturally, many of the checking or monitoring instruments serve a secondary function as trouble shooting tools, but only in those circuits to which they are permanently connected. A process control instrument should never be used for trouble shooting in another circuit—sooner or later you'll forget to put it back, or the other fellow will hang a lower voltage meter on a 600 volt circuit and there will be nothing to put back!

One of the most surprised—and lucky—men I have seen, was an employee of one of our Fluflon Licensees. During the installation of the machinery, a technician had been using (correctly) a combination volt-ohm-milliammeter to measure the resistance of a control circuit element. Our lucky man borrowed the instrument, still adjusted to indicate resistance, and applied the test probes across one phase of a 440-volt power circuit. The fault current, flowing through the little dry cell in the meter circuit, produced enough heat to disintegrate the battery and the instrument case along with it, but without injury to the workman, which brings us face to face with the instrument selection and application problem.

The most important single factor to be considered in selecting an electrical instrument is the kind of current—whether it is alternating or direct. The first step, then, is the selection of the proper movement type. For direct current, a permanent-magnet moving coil instrument with its linear scale and low sensitivity to external magnetic fields is preferred. Alternating currents at commercial frequencies can be measured best with dynamometer or repulsion iron-type instruments.

Scale considerations

The second step is the selection of the proper full-scale range for the quantity to be measured. Here, some knowledge of the circuit or component is helpful, such as the fact that a 550-volt line is to be used or that the full load current of a certain motor is 27 amperes. When the amplitude of the voltage on a power circuit to be measured is unknown, a Wigginton circuit tester can be used to ascertain the approximate voltage. This same tester will indicate whether the circuit is alternating or direct current by vibrating on alternating current. When used with a steady resistive load, no 600 volt voltmeter would be harmed on a 10 volt circuit, but a 10 volt instru-

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ment on a 550 or 600 volt circuit would certainly be damaged.

Since most instruments have their accuracies specified as some percentage of the full scale value, more precise readings can be obtained when a range is selected which will allow pointer deflection to about 75% of full scale. When an ammeter is being selected, great importance must be attached to the selection of the scale range. Some cases of changing loads like motors, tungsten lamps and capacitors are apt to damage ammeters, if the circuit behavior is not fairly well understood. D-C ammeters should be protected against the heavy charging current of capacitors, the low reactance starting loads of motors, and the low resistance of cold lamps, by using shorting switches which can be opened after steady state conditions obtain.

Protecting instruments

Voltmeters must be protected against damage due to extremely high induced voltages, such as might be caused when the field circuit of a motor is opened. The instrument must be disconnected from the circuit by removing a lead or by opening a series switch. Thermocouple type ammeters have two serious application drawbacks when they are considered in the trouble-shooting category. They have very low overload capacity and, usually, square law scales which crowd the lower half of the full scale range into one-fourth of the scale length.

When the proper type of instrument has been selected, there are three very practical precautions which should be observed. The first two affect the accuracy of the readings and are the presence of strong external magnetic fields which could be due to heavy current flow in adjacent conductors, and the wave form of the current and voltage in the circuit.

A short time ago one of our engineers was investigating the effect of a wide range of a-c voltages on the operation of a relay. He was using a Variac as the adjustable voltage source and an unshielded repulsion-type voltmeter to measure this voltage. The instrument indication became very erratic and was indicating a higher output voltage than the Variac was capable of producing. The higher reading was observed only while the relay was connected to the Variac. We finally learned that the voltmeter was being affected by the magnetic field around the Variac

The third, but not the least important is the line to ground potential of the circuit. The insulation rating of the instrument must not be exceeded if it is mounted on a grounded panel or placed on a machine during circuit testing.

There are some definite standard application rules for the use of shielded and unshielded instruments near strong external magnetic fields. A good working rule in trouble shooting, if the instrument accuracy is to be preserved, is to space the instrument at least one diameter (or face width) away from suspected magnetic fields or other instruments. Most clamp-on type instruments are designed so that the movement will be safely beyond the field produced around the conductor in which the current flow is being measured.

Wave forms, particularly in certain types of direct current circuits, can make a great difference in instrument indication. The interpretation of an indication is frequently influenced by the wave shape of the current or voltage in the circuit.

In addition to the circuit requirements which influence the selection of an instrument, some thought must be given to any unusually severe conditions which may exist external to the instrument. Instruments of modern design can be used over a fairly wide range of adverse conditions, but large variations in temperature, humidity, or vibration might dictate the use of special enclosures or mounting methods.

At Universal we have, recently, traced the reason for the high mortality rate of a three and one-half inch voltmeter mounted on the cover of a control enclosure, to a relatively high rate of vibration. This vibration caused loosening of a screw which supports the multiplier within the instrument case. Obviously, panels upon which instruments are mounted should not be drilled or subjected to impacts until after the instruments have been removed. We are very familiar with a certain precision portable voltmeter whose upper control spring can easily be tangled, turn upon turn, if the instrument is jarred in a direction normal to the plane of the spring.

High humidity and corrosive atmospheres have just about the same adverse effect upon instruments. The difference is one of degree. Instruments used in areas of high humidity in textile mills may experience accumulations of moisture within the case if the room temperature drops suddenly. Periodic examinations of the interiors of instruments, used under questionable ambient conditions may be well worth the time spent.

Wave sharpe effects

A moment ago we said that the accuracy of an instrument reading could be affected by the wave shape of the applied voltage or current. In general, this consideration applies to direct current circuits where the choice of instrument type depends upon whether the source voltage is steady—if a battery; contains a ripple component —if a generator; or is pulsating, if the output of a rectifier.

Instruments of the permanent magnet moving coil type, characterized by linear scales, measure the average value of voltage or current. Electrodynamic, repulsion iron, and thermocouple type instruments indicate the effective or root-mean-squared value of the characteristic being measured. Of the three types, the permanent magnet moving coil instrument requires the least energy due to the strong field of the permanent magnet. The electrodynamic instrument places the greatest burden on the power source.

For example, when a direct current motor is operated on rectified current and the heating effect of the current in the motor must be determined, use instruments that will indicate r.m.s. values. To determine the effect of current on the torque produced by the motor use average indicating instruments.

On steady direct current any of these instruments will give exactly the same indications. When the output of a generator must be measured, there will be a difference in reading between r.m.s. and average instruments, depending on the amount of ripple. When the minimum voltage, due to the ripple is not less than 65% of the maximum voltage, the difference indicated by the two types of instruments will not exceed one per cent.

Practically, the instrument accuracies, except when brand new, are probably worse than plus or minus one per cent, so that either kind of instrument could be used in most direct current power circuits where the ripple voltage is low. The general practice, how-

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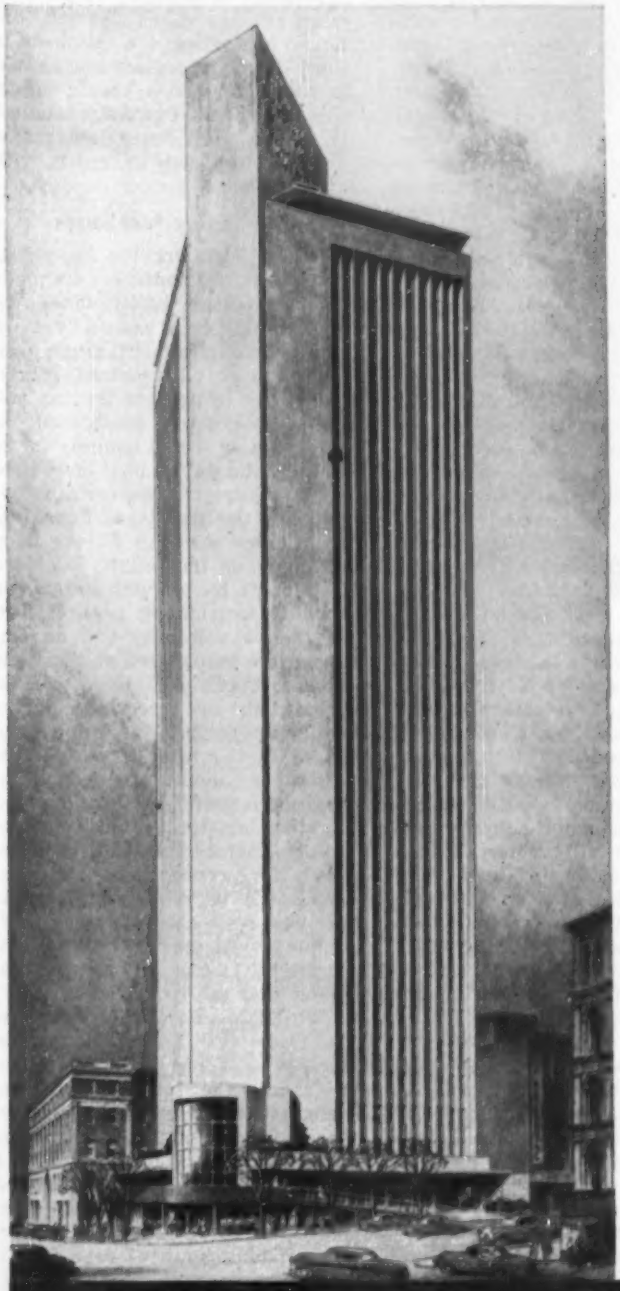

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ever, is to use averaging (permanent magnetic moving coil) instruments to measure steady and ripple direct currents.

When the output of rectifiers must be measured, r.m.s. instruments should be used, especially when the loads are resistive and the production of heat is the function of the system. If only averaging instruments are available and there are no filtering or smoothing components in series with the load, the instrument reading must be multiplied by a form factor suitable to the wave shape of the voltage or current.

When the current is halfwave pulsating direct the indication of the permanent magnet moving coil instrument must be multiplied by 1.57. If the rectification is full wave, the multiplier is 1.11. When all three phases of an alternating source are rectified into one output, the instrument is looking at a low ripple characteristic and the indication may be used without a correcting multiplier.

In direct current circuits two instruments, an ammeter and a voltmeter can be used to completely describe the behavior (or misbehavior) of the circuit. The types of instruments should be chosen with the foregoing information in mind.

Rugged meters needed

At best, trouble shooting can be quite abusive on instruments and probably all of the wrong things which can be done to instruments will be done to those that are used in trouble shooting service. Extremely high accuracy, usually, is not a requisite since most industrial equipment can perform satisfactorily on voltages ten per cent above or below the device rating. The portable type instrument chosen need not have an accuracy better than one or two per cent, but probably you cannot purchase anything worse than ½ of one per cent.

Separate units should be used, rather than multi-purpose instruments, so that simultaneous voltage and current readings can be taken. The instrument cases should be the type that have tight fitting covers and leather carrying straps. When not in use they should be stored in locked, clean, dry cabinets. The movements should be the permanent magnet moving coil type, although one or two r.m.s. indicating instruments would be handy to have around. Scales should be evenly divided and four to six inches long for accurate and easy reading. Select a make of instrument that features dull white scales with sharp deep black graduations and knife edge pointers.

Portable voltmeters are available in two and three scale ranges. A good range choice will include a voltage scale that is maybe 25% greater than the highest d-c voltage in the mill. The choice of lower voltage ranges will depend upon other common voltages that may have to be checked. Voltmeter sensitivity should be high so that the instrument will not change the characteristics of high impedance circuits. Portable d-c ammeters are available in one or three scale ranges, with self-contained shunts in ranges up to 500 amperes. The highest range selected must be somewhat higher than the full load current of the largest d-c load in the mill. The lower ranges will be governed by other typical loads. A permanent magnet moving coil millivolt meter can be used with a number of shunts, and a set of calibrated test leads, to measure any desired series of current ranges. Incidentally, portable shunts, if used, must be handled as carefully as the instruments they are used with. Nicks or deformation will change the calibration.

In a mill where there are extensive applications of electronic devices and modern control equipment, additional instrumentation will be needed. Multipurpose, multirange instruments are commonly used in servicing these circuits. Several manufacturers market volt-ohm-milliameters having large scales calibrated in d-c and a-c volts with five or six full scale ranges from two and one-half volts up to five thousand volts. Five or more d-c current ranges can be had with full-scale deflections from a fifty micro-ampere low to about ten amperes maximum. Miniature, self-contained twenty-two and one-half volt dry batteries permit inclusion of circuits and scales which will indicate values of resistance as high as forty or fifty million ohms. The movement in these instruments are almost always the permanent magnet moving coil types with twenty thousand ohms per volt sensitivity. The various functions and ranges are selected by means of one or two rotary switches.

When the instrument is used to measure alternating voltages, a small rectifier is switched into the circuit along with the appropriate scale multiplier. Generally, this rectifier will reduce the effective movement sensitivity to between five and ten thousand ohms per volt. The a-c scales of these combination instruments are usually calibrated to give r.m.s. values of voltage even though the meter movement is actually responding to an average value. The self-contained batteries are subject to shelf life deterioration and should be replaced when full scale deflection (zero ohms) cannot be attained on the highest resistance range, with the test leads in contact with each other.

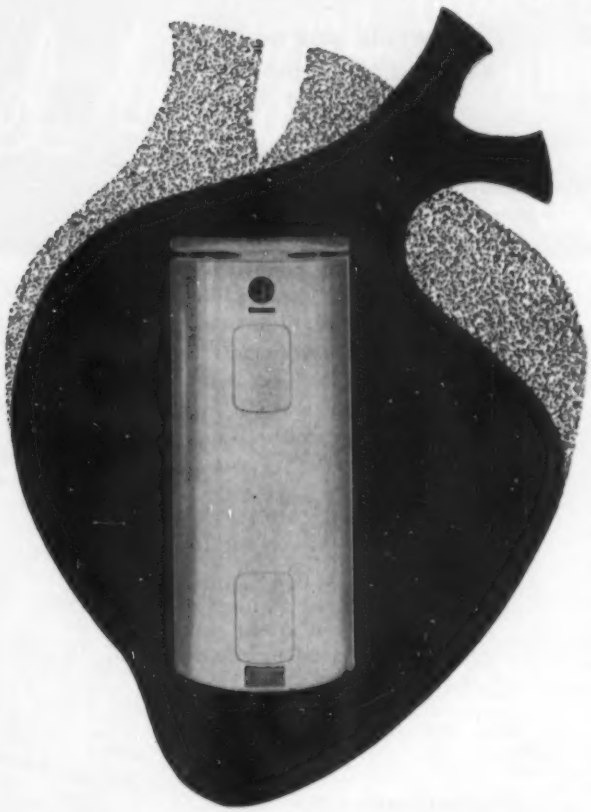
Making up test loads

If test leads for the individual voltmeters and ammeters are made by the plant electricians, the cable construction should be extra flexible stranding with tough plastic or other oil resistant insulation. Lugs to prevent fraying and to insure positive contact should be brazed or staked securely to the wire. If shunts are part of switchboard equipment, be certain that some of the test leads have legs with holes sized to fit the drop terminals on the shunts. Standard lead length for use with shunts and portable instruments is three feet.

When a voltmeter and an ammeter are being used at the same time to check a d-c load, certain precautions are necessary. If the voltmeter resistance is high compared to the load resistance, the voltmeter should be connected across the circuit between the load and the ammeter, so that the actual voltage, across the load, is measured. If, however, the ammeter resistance is very low compared to the load resistance, then the preferable voltmeter connection is across the circuit between the ammeter and the source.

While the characteristics of the d-c circuit can be completely described and its troubles located with only the voltmeter and the ammeter, trouble shooting in anything but the simplest alternating current circuit containing only a resistive load may require several additional instruments. To completely describe the input characteristic of a squirrel cage motor, for example, will require a voltmeter, an ammeter and a wattmeter or power factor meter. Either of the two latter instruments are required because of the

(Continued on page 107)



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Case histories in labor relations

How would you have handled these labor grievances?

This roundup of day-to-day problems in labor relations provides an opportunity to test your judgment as to what is right and wrong. Each incident is an actual grievance that went to arbitration. Names have been changed for obvious reasons, but readers may obtain actual citations on any specific case by writing to the editor.

Incentive problem

Can an employer discipline a worker who stood around idle after he completed the minimum called for under an incentive system?

What happened

Under the company's incentive plan, 60 units an hour was considered the accepted minimum standard of output. By 2 p.m., Andy Remak had put out 480 units. Quitting time was 4 p.m., but Andy went to his foreman and asked leave to go home. "I made my minimum — I got nothing else to do," he said.

"You go back and turn out more work," the foreman said. "You can use the extra money."

Andy returned to his job but didn't do any work. He was given a 2-day suspension. Andy's union took up the case because it considered that many important issues were involved here. At the arbitration, the union presented its side:

(1) Andy put in a 'full day's work' when he produced 480 units

which was the minimum requirement. Because he did such a 'stupendous' job in 6 hours instead of 8, he should not be penalized.

(2) An '8-hour day' doesn't mean that an employee has to have his nose to the grindstone every minute.

(3) If Andy has found a shortcut to producing the required units, he should be free to use the extra time as he sees fit.

Management had other ideas:

(1) If a worker is told to work by his supervisor, as Andy was, he should obey, and not loaf.

(2) A 'workday' means than an employee should *work* during that period without regard to minimum output. The employee cannot at his whim decide to work less because he had produced the minimum requirement.

Was the company: Right ☐ Wrong ☐

What arbitrator ruled: "The purpose and concept of incentive production would be destroyed if an employee stopped producing after the minimum work units had been attained. The very existence of the incentive plan is indicative of the mutual desire of the parties to *increase* normal production and to afford the employees an opportunity to increase their earnings through incentive effort.

"The union's concept that an employee, working on an incentive basis, may cease productive activity after attainment of the minimum requirement is entirely foreign to the universally accepted concept and practice that an employee is expected to exceed normal production by working at an accelerated, or incentive, pace throughout the hours of work specified in a given work-day or work-shift.

"In conclusion the arbritrator must support the position of the company that incentive workers are required to work a full day, consisting of 8 hours. The union has failed to justify its contention that an employee has the right to stop productive activity, during a work-day, on the basis of units earned."

Dividing overtime

If an employee's turn to work overtime is skipped by mistake, when doesn't management have to pay the worker for such an error?

What happened

Many employees welcome an opportunity to put in some overtime so they can reap the extra pay. And because it pays so well (time and a half), workers jealously guard their turn to work the extra hours. Here was a company

which had a specific policy on overtime distribution. It read: "Overtime worked in any department shall be divided as equally as possible and practicable among the employees of that department provided the employee has had previous experience in the particular class of work on the job to be assigned and is able to do the particular work involved without further training."

When overtime was to be assigned, the foremen in the department would make up a list of employees entitled to the extra hours. Opposite the name of the eligible men was the number of hours each employee had already put in on overtime. This list was posted near the time clock so workers could see when they were scheduled and who was eligible. Tom Burnette had 352 hours of overtime under his belt and another fellow in his department (Dobson) had 356. *(Continued on page 106)*

Why Sorgel dry-type transformers were selected

for the two largest buildings erected in New York City since the war

SOCONY MOBIL BUILDING, the largest air-conditioned office building in the world.

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Higher voltage distribution, with dry-type transformers at load centers, which we have been advocating for 40 years, is now recognized as the most efficient and economical method of interior electrical distribution. It has been adopted for the Socony Mobil Building and the new Coliseum in New York City.

NEW YORK COLISEUM, the largest exhibition building of its kind in the world.

Architects: Leon and Lionel Levy, with Aymar Embury II, Otto Eggers of Eggers & Higgins, and John B. Peterkin, as a consulting and advisory committee.
Engineer: Guy B. Panero.
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The engineers' principal requirement was that the transformers have a low sound level. Regular tests, made in our laboratory, prove that the sound level of SORGEL dry-type transformers is well below the established standards. Because of their unusually quiet operation, SORGEL transformers are particularly adaptable for any indoor installations.

Liberal Design for Full Rated Load

SORGEL dry-type transformers are guaranteed to carry the full load continuously at a safe, low operating temperature. They are so liberally designed that they can safely carry an overload during an emergency.

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Sales Engineers in Principal Cities

Know the law

by Arthur L. H. Street

Right to lien lost through late filing

◆ IN ALL STATES—or at least most—an electrical contractor can enforce a lien against privately owned real estate for work and materials furnished in the construction, repair or improvement of a building. This is so whether the contract is direct with the owner or a subcontract with a general contractor. But this lien privilege exists subject to the conditions fixed by statute, as to when and how the lien claim shall be filed, etc. Usually, if any one of the conditions is not complied with the lien right is lost.

A decision rendered by the Louisiana Court of Appeal Second Circuit in the case of Electric Contracting Company v. Brown, 39 So. 2d 100, illustrates one of the several ways in which right to a lien may be lost: by not filing the lien claim within the time required by law.

Brown and his wife hired a building contractor to erect a house for them, and the contractor sublet to the electric company all the electrical work at a lump sum price. That work was completed March 10, 1947, and, to have preserved right to a lien against the premises the electrical contractor should have filed its lien claim within sixty days after that date. It was not filed until June 13, 1947. Suit to enforce a lien was dismissed because the filing was too late.

The electrical company unsuccessfully tried to uphold the lien claim because on April 25, 1947, two of its workmen returned to the premises to replace a ground clamp which did not conform to the requirements of a local city ordinance. The company claimed that the job was not *complete*, for the purposes of filing a lien claim, until that replacement was made, and that the filing within 60 days after April 25 was timely. The trial judge upheld the company's contention on this point, but on the owners' appeal to the Court of Appeal, that court upset the lower court's decision, and ordered the suit dismissed. Here is the reasoning of the higher court:

When is job "completed"?

" * * * The electrical fixtures and system were in complete use after March 29th. The ground clamp installed in March, although it did not meet the requirement set forth in the Alexandria city ordinance, was nevertheless usable and effective.

"Under these circumstances, we think the" decision in the case of Hortman-Salmon Company, Inc., v. White, 168 La. 1067, 123 So. 715, "is applicable, and, as stated by the Court in that case, *the last labor is done and the last service or material is furnished, within the contemplation of the lien statute, when the building is treated as completed and the correcting of defects which may appear from time to time in the work after the building is considered and treated as completed, is not to be considered * * * as part of the labor contemplated by the statute in fixing the time.* Otherwise, * * * the time within which to record liens might linger indefinitely and the rank of mortgages and other claims against the property might be displaced unreasonably."

"In the case before us, no additional materials were furnished on April 25th. The cost of the ground clamp was approximately $1.00 and there is no testimony that the clamp first installed was of less value than the replacement clamp installed in April. Plaintiff has cited" a decision in another case, deciding that "where a city ordinance requires inspection and approval, there can be no last delivery or last performance as respects time for recording liens until after such inspection and approval. This point is not" mooted "in the case before us as there is no testimony * * * that approval by the City of Alexandria was delayed until after the installation of the new clamp on April 25th.

"Plaintiff is claiming the benefit of a lien by virtue of the statute. The burden of showing that his claim comes within the statute is upon the plaintiff. We believe that the burden has not been met."

When building not finished

The decision in the case above reviewed was mentioned by the Louisiana Court of Appeal, First Circuit, in the case of Cain v. Central Plumbing & Heating Company, 85 So. 2d 376, involving a closely related point of lien law. In that case a contract contemplated erection of a two-story building but due to the owner's lack of funds the project was modified, after the upstairs work had only been partly done, by finishing the structure as a one-story affair. The court decided that, for the purpose of filing a lien claim, the work must be deemed to have been completed when the final labor was finished and the building was occupied, even if afterwards minor repairs or correction of defects or minor additions to the work were performed.

Know your state law

The Louisiana decisions here reviewed are in line with what the appellate courts of some other states have decided. But the electrical contractors of each state should check with their local attorneys if uncertain as to just what steps must be taken to preserve and enforce liens.

Below we briefly indicate what has been decided in other states where ELECTRICAL SOUTH circulates:

In the following states the courts have decided that it is essential to the validity of a lien that claim be filed within the time required by statute: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kansas, Kentucky, Maryland, Missouri, Oklahoma, Tennessee, Texas, Virginia, and West Virginia.

In the following states it has been decided that the time for fil-

(Continued on page 105)

Note: Asterisks * * * indicate that words or sentences have been omitted from verbatim court decisions.

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- Provides **ceiling illumination** as well as **evenly distributed floor lighting.**
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Here is a unique ceiling pan fixture design for either commercial or residential installation. For further information fill in and mail the attached coupon today.

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HH-11	10″	1-100 W
HH-13	12″	2- 75 W
HH-15	14″	2-100 W
HH-17	16″	3-100 W

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New, revised estimating tables continued in this issue

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

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NEW WOOD COMMERCIAL STORES

NO. COND'R'S SIZE	HOURS PER C	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
2/14	4.6	.058	.069	.081	.092	.104	.115	.127	.138	.150	.161	.173
3/14	4.9	.061	.074	.086	.098	.110	.123	.135	.147	.159	.172	.184
4/14	5.2	.065	.078	.091	.104	.117	.130	.143	.156	.169	.182	.195
2/12	4.6	.058	.069	.081	.092	.104	.115	.127	.138	.15	.161	.173
3/12	5.0	.063	.075	.088	.10	.113	.125	.138	.15	.163	.175	.188
4/12	6.0	.075	.09	.105	.12	.135	.15	.165	.18	.195	.21	.225
2/10	4.9	.061	.074	.086	.098	.11	.123	.135	.147	.159	.172	.184
3/10	5.4	.068	.081	.095	.108	.122	.135	.149	.162	.176	.189	.203
4/10	6.3	.079	.095	.110	.126	.142	.158	.173	.189	.205	.221	.236
2/8	5.4	.068	.081	.095	.108	.122	.135	.149	.162	.176	.189	.203
3/8	6.3	.079	.095	.11	.126	.142	.158	.173	.189	.205	.221	.236
4/8	7.1	.089	.107	.124	.142	.16	.178	.195	.213	.231	.249	.266
2/6	6.3	.079	.095	.11	.126	.142	.158	.173	.189	.205	.221	.236
3/6	6.9	.086	.104	.121	.138	.155	.173	.19	.207	.224	.242	.259
4/6	8.0	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
2/4	7.3	.091	.11	.128	.146	.164	.183	.201	.219	.237	.256	.274
3/4	8.4	.105	.126	.147	.168	.189	.21	.231	.252	.273	.294	.315
4/4	9.2	.115	.138	.161	.184	.207	.23	.253	.276	.299	.322	.345

E-101-B

LABOR: Includes drilling, cutting, installing, strapping and connecting boxes. (No taps or makeups of joints.)

6-56

Electrical Estimating—III

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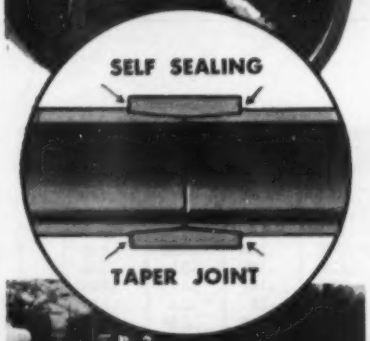
SMOOTH BORE!



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Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

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NEW WOOD OFFICE BLDG'S.

NO. CONDR'S SIZE	HOURS PER C	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
2/14	5.1	.064	.077	.089	.102	.115	.128	.14	.153	.166	.179	.191
3/14	5.4	.068	.081	.095	.108	.122	.135	.149	.162	.176	.189	.203
4/14	5.8	.075	.087	.102	.116	.131	.145	.16	.174	.189	.203	.218
2/12	5.2	.065	.078	.091	.104	.117	.13	.143	.156	.169	.182	.195
3/12	5.7	.071	.086	.10	.114	.128	.143	.157	.171	.185	.20	.214
4/12	6.9	.086	.104	.121	.138	.155	.173	.19	.207	.224	.242	.259
2/10	5.4	.068	.081	.095	.108	.122	.135	.149	.162	.176	.189	.203
3/10	6.1	.076	.092	.107	.122	.137	.153	.168	.183	.198	.214	.229
4/10	6.9	.086	.104	.121	.138	.155	.173	.19	.207	.224	.242	.259
2/8	6.1	.076	.092	.107	.122	.137	.153	.168	.183	.198	.214	.229
3/8	6.9	.086	.104	.121	.138	.155	.173	.19	.207	.224	.242	.259
4/8	7.8	.098	.117	.137	.156	.176	.195	.215	.234	.254	.273	.293
2/6	7.1	.089	.107	.124	.142	.16	.178	.195	.213	.231	.249	.266
3/6	8.2	.103	.123	.144	.164	.185	.205	.226	.246	.267	.287	.308
4/6	9.2	.115	.138	.161	.184	.207	.23	.253	.276	.299	.322	.345
2/4	8.7	.109	.131	.152	.174	.196	.218	.239	.261	.283	.305	.326
3/4	9.5	.119	.143	.166	.19	.214	.238	.261	.285	.309	.333	.356
4/4	10.1	.126	.152	.177	.202	.227	.253	.278	.303	.328	.354	.379

E-101-B

LABOR: Includes drilling, cutting, installing, strapping and connecting to boxes. (No taps or makeup of joints.)

6-56

ARMORED BONDED CABLE
NEW WOOD WAREHOUSES

NO. CONDR'S SIZE	HOURS PER C	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
2/14	5.8	.048	.057	.067	.076	.086	.095	.105	.114	.124	.133	.143
3/14	4.1	.051	.062	.072	.082	.092	.103	.113	.123	.133	.144	.154
4/14	4.3	.054	.065	.075	.086	.097	.108	.118	.129	.140	.151	.161
2/12	5.8	.048	.057	.067	.076	.086	.095	.105	.114	.124	.133	.143
3/12	4.1	.051	.062	.072	.082	.092	.103	.113	.123	.133	.144	.154
4/12	5.1	.064	.077	.089	.102	.115	.128	.140	.153	.166	.179	.195
2/10	4.0	.050	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15
3/10	4.5	.056	.068	.079	.09	.101	.113	.124	.136	.146	.158	.169
4/10	5.2	.065	.078	.09	.104	.117	.13	.143	.156	.169	.182	.195
2/8	4.5	.056	.068	.079	.09	.101	.113	.124	.135	.146	.158	.169
3/8	5.1	.064	.077	.089	.102	.115	.128	.14	.153	.166	.179	.191
4/8	5.8	.075	.087	.102	.116	.131	.145	.16	.174	.189	.203	.218
2/6	5.3	.066	.08	.093	.106	.119	.133	.146	.159	.172	.186	.199
3/6	6.0	.075	.09	.105	.12	.135	.15	.165	.18	.195	.21	.225
4/6	6.8	.085	.102	.119	.136	.153	.17	.187	.204	.221	.238	.255
2/4	6.5	.081	.098	.114	.13	.146	.163	.179	.195	.211	.228	.244
3/4	7.2	.09	.108	.126	.144	.162	.18	.198	.216	.234	.252	.27
4/4	8.2	.103	.123	.144	.164	.185	.205	.226	.246	.267	.287	.308

E-101-B

LABOR: Includes drilling, cutting, installing, strapping and connecting to boxes. (No taps or makeup of joints.)

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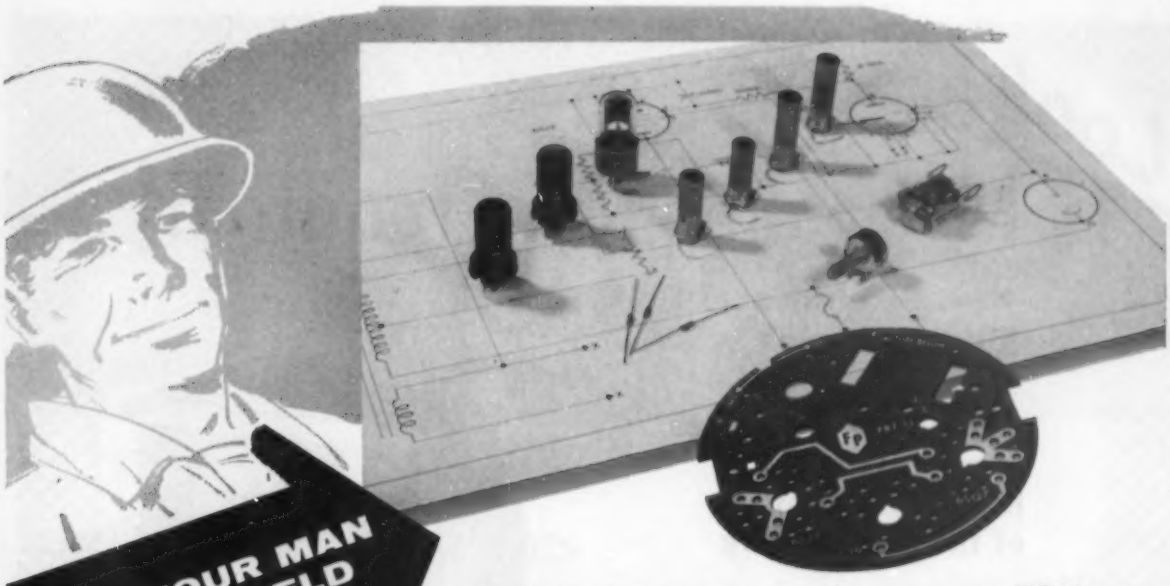

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A look inside any Fisher-Pierce photoelectric lighting control immediately reveals a primary reason why they require extremely low maintenance and provide long-run economy: *component quality*. Here are specific examples: two *pre-aged* amplifier tubes, instead of one dual triode, for a guaranteed minimum life of 20,000 hours; *wire wound* potentiometer; *Sigma* sensitive relay for low plate current drain of power tube; *linen-based bakelite* sub-mounting chassis and etched circuitry; *metal encased* paper capacitors (no electrolytics); blue-sensitive 1P39 phototube with non-hygroscopic base. No other photoelectric control provides such consistently high component quality. Combined with this are these four other important features:

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This new B&C design is undoubtedly the finest METER TROUGH ever made . . . it truly deserves your most careful consideration for any type of installation. One of the big features is *plenty of wiring space* . . . the single units are 8" x 8" x 3¼" . . . the multiple units are on 8" centers both horizontally and vertically. All conduit hubs are interchangeable on standard openings of 1¼", 1½", and 2" and 2½". Interchangeable 1" openings are available if required. Hubs may be ordered separately.

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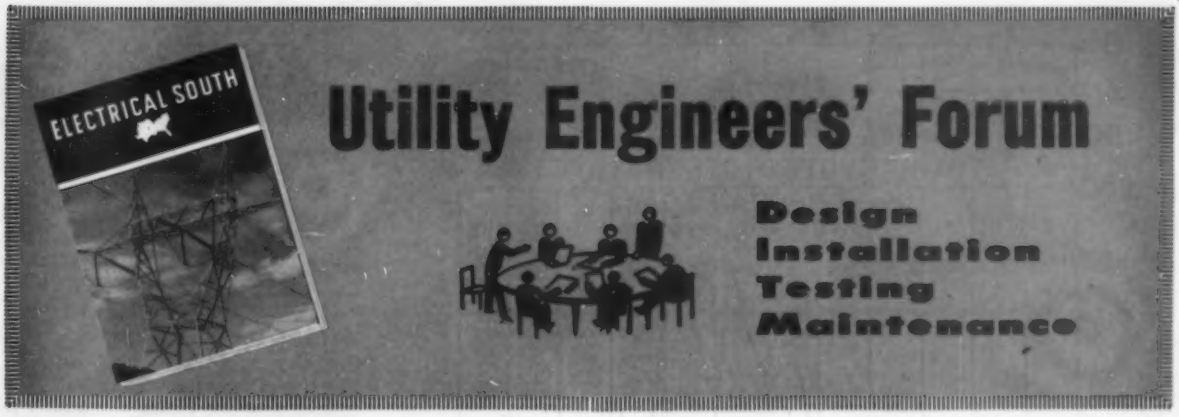


Selecting thermostatic switches for secondary capacitor control

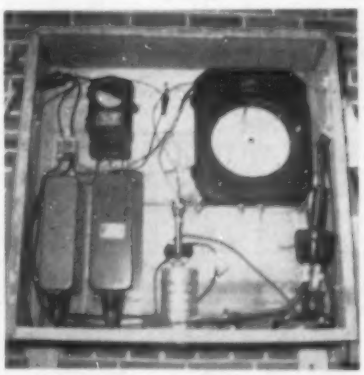
By W. P. McCormick, District Engineer, Arkansas-Missouri Power Co., Blytheville, Ark.

◆ THE HIGH SATURATION of room-type air conditioners in certain residential areas has made it necessary to install large numbers of 3-kvar and 5-kvar 240-volt secondary capacitors in these areas to correct the power factor to a more tolerable value. Incident to these installations has arisen the problem of what to do about the large excess of these capacitors which are not needed, in fact not at all desirable, at times when these room air conditioners are not in operation.

We found, due to the high cost per kvar of secondary capacitors and the large number of units that would have to be disconnected and reconnected, that manual switching could not even be considered. Also, it was found that very few, if any, conditioners would be in operation unless the ambient temperature exceeded about 85°F. For this reason, it was felt that some form of thermostatic switching would be preferable. The next problem was to find a thermostat that could satisfy the main requirements: (a) low initial cost per unit; (b) long life; (c) weather resistance; and (d) ease of installation.

After making a number of inquiries, we had one manufacturer furnish us with a switch designed for use with the 3-kvar capacitor. This particular thermostat seemed to be what we wanted, as it was small and incased in rubber for weather resistance, low-cost, about $2.50 per unit, could be easily mounted, due to an integral bracket which could be attached directly to the capacitor terminal, and had a lead which could be connected directly to the secondary.

The operating temperature range was about what we wanted. The turn-on was at approximately 85°F, and the turn-off at approximately 70°F. This last figure, however, had to be reevaluated because of the heating effect of the normal capacitor current flow through the thermostat when in the closed position. It was found that this heating effect, with a 3-kvar capacitor, was sufficient to keep the thermostat closed until the temperature had dropped to about 65°F, and with the 5 kvar unit this value was about 55°F. It was decided that due to the lag in inside air temperature compared to the outside ambient, this difference would be satisfactory.



The equipment arrangement shown here was used to make life tests on thermostatic switches being considered for control of capacitors.

Our next problem was to determine whether the switch would withstand enough switching operations of capacitive current before necessity for replacement would arise to make it economically feasible to use it. Since the manufacturer could not furnish us this information, we decided to run a life-test of our own. First of all, we examined the maximum and minimum temperature records for the past several years, and found that with the temperature range of these thermostats, we could expect an average of about 60 operations (on and off) per year.

We then set up a test, connecting one thermostat in one line lead of a 3-kvar capacitor, and one in one lead of a 5-kvar unit. We arranged the two thermostats above a light bulb, which was controlled by a time switch so as to come on for 15 minutes every hour. Since this was for test purposes, the mounting brackets of the thermostats, which are one terminal, were connected together, and to one side of a 240 volt line. The lead (other terminal) of one was then connected to a 3-kvar capacitor, and that of the other to a 5-kvar capacitor. The other terminals of both capacitors were then connected together, and

(Continued on page 105)

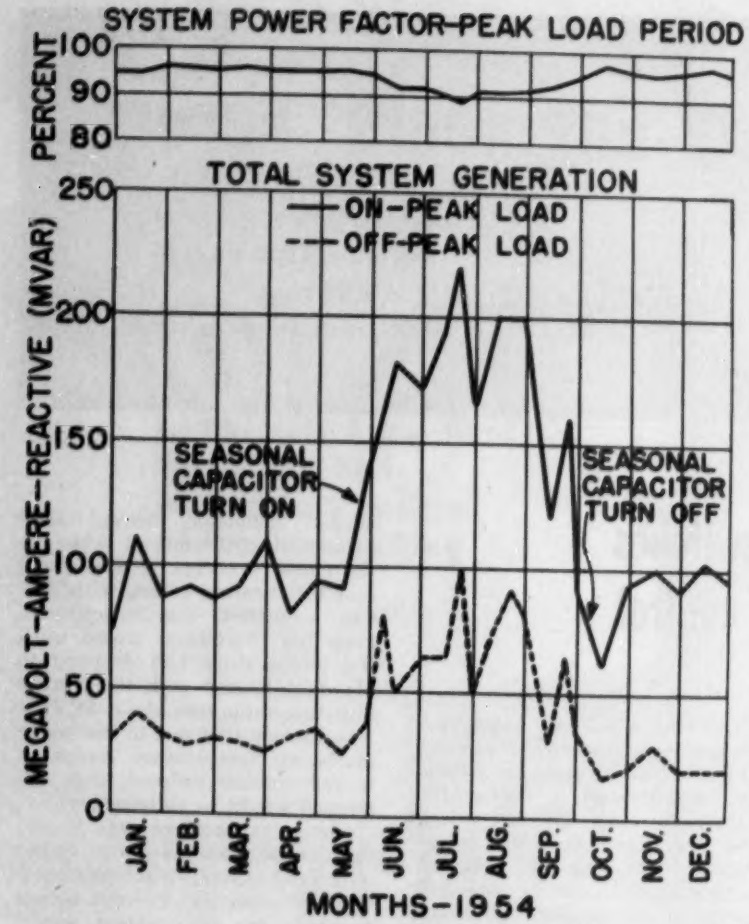


Figure 1. The seasonal nature of Oklahoma Gas and Electric Company's system reactive load is illustrated by this 12-month record.

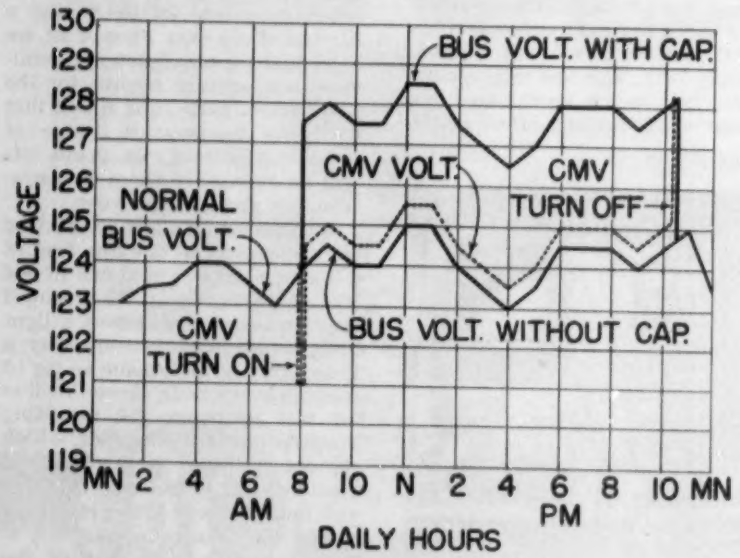


Figure 2. Substation switched capacitor banks which had been voltage controlled were changed to operate on voltage compensated by time clock. The clock connects a voltage dropping resistor in the voltage control circuit of contact making voltmeter.

By V. D. Weber, Operations Specialist, Oklahoma Gas and Electric Co., Oklahoma City

◆ CAPACITOR bank switching is used by the Oklahoma Gas and Electric Company to supply the system reactive loads. Switching is required because reactive loads during on-peak periods far exceed that of off-peak periods. System generation power factor limits were established as follows: on-peak—95% maximum; on-peak—86% minimum; and off-peak—unity maximum.

Capacitor installations were engineered to operate the system with the above limitations. The reactive load existing in winter and spring seasons of the year indicated that some switched capacitor banks use had to be discontinued throughout those seasons. This paper shows the results of switching capacitor banks to supply system reactive loads.

Capacitor banks on system

A total of 206,535 reactive kilovolt-amperes (kvar) in capacitor banks were installed on the system by June, 1954. Of this total twenty-nine per cent, 59,880 kvar, were installed as fixed banks. The remaining 146,655 kvar were installed as switched capacitor banks. The six different methods used for controlling the switched capacitor banks are as follows:

(1) Manual
(2) Current
(3) Voltage
(4) Time Clock
(5) Voltage compensated by current
(6) Voltage compensated by time clock

Of the 340 switched capacitor banks in use, eighty-one per cent, 321 banks totaling 118,470 kvar, were under the control of a time clock.

System reactive load

Information concerning total load on the company's system was obtained at the central dispatching office. Four hourly readings were taken from system generating data. Those readings were:

Capacitor switching

Metering reactive loads at selected points proves time clock switching of capacitors is practical for control of reactive kva

4:00 a.m.—Reactive on system during off-peak load periods.

8:00 a.m.—System reactive load at a time most capacitors would be in use.

3:00 p.m.—Coincides with time the heaviest summer system load occurs.

Evening Peak—Period varies between 7:00 p.m. to 9:00 p.m. and shows system reactive loading at that time.

Figure 1 is a record of the daily "on-peak" and "off-peak" reactive load periods as supplied by the system generating plants. The system power factor for the "on-peak" load period is also shown. The heaviest loads occurred during the summer, at which time the total generating power factor was not lower than 88.5%. For approximately ten months of the year, the power factor was not less than 90%, and for over seven months, the power factor was not lower than 94%.

All switched capacitor banks were turned on for normal use during June, 1954. This was the time when the system reactive load had exceeded 100,000 kvar or the generation power factor was consistently less than 95% on-peak. Some switched capacitor banks were turned off in the winter when the system generation power factor reached 95% and loads were decreasing because of the temperature changes of this season. Turn-off occurred in October, 1954. The lower reactive loads experienced during the winter and spring seasons required a "turn-off" from normal "on" operation of 48,365 kvar grouped in 79 banks. This turn-off of switched capacitor banks left on the system for normal operation one 300 kvar switched capacitor bank on each 4 kv and 12.5 kv feeder circuits and all fixed capacitor banks.

Clock controlled switching

The 321 banks of time clock controlled switched capacitor installations constitute 81% of all switched banks and 50% of all capacitor banks. The "on" and "off" time clock settings were made according to the data accumulated in a 30,000 kva area load study. Specific points noted in the study were the time of rise and fall of reactive loads and the amounts of reactive load that existed during various seasons throughout the year.

Three methods of establishing time clock settings are as follows:

(1) A 300 kvar switched capacitor bank located on a distribution circuit near its feeder center had a "time-on" setting selected to lag the normal circuit reactive load increase occurring in the morning. The "time-off" setting was selected to precede the reactive load decrease expected on that circuit.

The time settings on a second or third capacitor bank on the same circuit were selected to be at least 10 to 15 minutes away in time for any other bank on that circuit. Figure 3 is a graphic chart showing 2-300 kvar switched banks operating on one circuit.

(2) A substation clock controlled

(Continued on page 103)

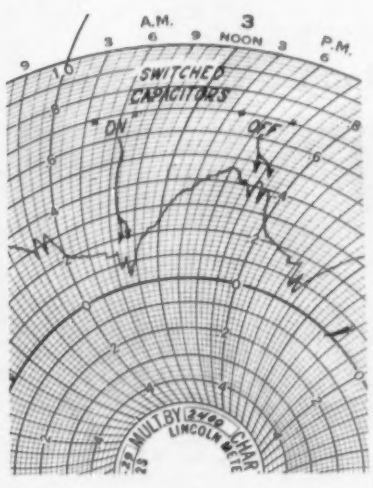


Figure 3. Reactive load recording at 2500 kva substation.

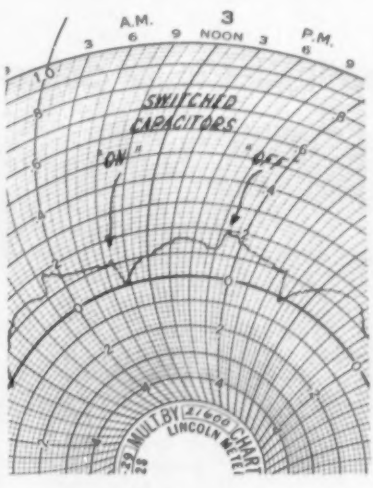


Figure 4. Reactive load recording at 18,000 kva substation.

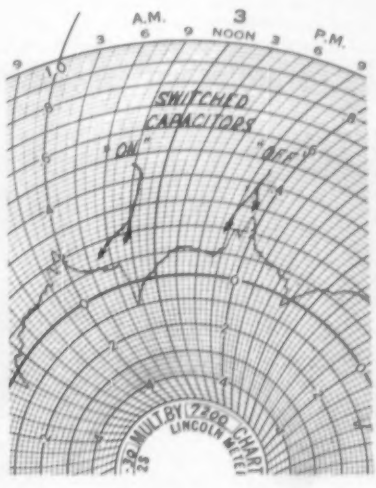


Figure 5. Reactive load recording at 12,750 kva substation.

Southeastern utility engineers

◆ PROTECTIVE RELAYING specialists from 12 Southern and Southwestern states gathered recently at the Georgia Institute of Technology, Atlanta, for the Institute's annual conference on protective relaying. The conference was sponsored by the American Institute of Electrical Engineers and presented by the Georgia Tech Engineering Experiment Station and School of Electrical Engineering in co-operation with the Institute's Engineering Extension Division.

H. P. Peters, of the Engineering Experiment Station, presided over the opening session which included a welcoming address by J. W. Mason, dean of engineering, and a discussion of "The Elements of Relaying," by Dr. W. J. McKune, professor of electrical engineering. While this address was presented with a view of giving the less experienced relay engineers a better understanding of the fundamentals of the subject, it proved to be a thought provoking analysis of relaying problems, beneficial to all who heard it.

Elements of relaying

Dr. McKune pointed out that as an introduction to relaying, we might first consider all of the quantities which the relays could measure at one point and how each of these might be used to detect whether or not an abnormal condition existed.

He listed as measurable quantities: current, both instantaneous and effective, line and phase; voltage, both instantaneous and effective, both line and phase; time; temperature of apparatus; impedance or admittance; frequency; energy flow over a given time period; direction of power flow; magnitudes of higher harmonics in current and voltages; phase rotation of voltages and current; the symmetrical components of currents and voltages; and the presence of current, voltage, and power surges passing the point.

In addition, he pointed out that relays may obtain information by ability to compare the magnitudes and phases of the currents and voltages at two points in the system; or combine two or more of the above listed items in order to decide that an abnormal condition did or did not exist.

Dr. McKune then discussed how the measurement of these various quantities could be utilized to protect such equipment as alternators, transformers, transmission lines, and busses.

The concluding address of the first session was presented by L. R. Butt, Florida Power & Light Co., Miami, who discussed "Problems Encountered in the Installation of Differential Relays." Mr. Butt said that many more applications of differential relaying are being made today than have been made in the past. He said that when differential relays are included in an installation from the planning stage, the actual installation of the relays is usually far more simple than it is when differential relaying is applied to a station that has grown from a one or two distribution breaker station to a combination transmission and distribution station of major size.

Differential relaying

In discussing the field problems that enter into differential relay installation, Mr. Butt said that on his company's system, more misoperations of differential relays have occurred because of some type of an error at the current transformers than from any other place or point in the differential scheme. He recommended that every detail be checked beginning with the current transformer, including a ratio, excitation, and polarity test.

He said that if the current transformers have been in service before, a particularly thorough check must be made for multiple grounds. Such multiple grounds may cause the secondary circuit to have impressed across it any

These protection specialists participated in the conference . . .

R. J. Cooper, Ga. Power Co. | M. C. Johnson, S. C. Elec. & Gas | A. J. McConnell, General Electric | C. R. Goodroe, TVA

M. F. Hebb, Fla. Power Corp. | G. D. Rockefeller, Westinghouse | H. M. Hicks, Jr., Ala. Power Co. | C. M. Gadsden, Duke Power Co.

confer on protective relaying

difference in potential which might occur between the two grounding points. Recommended practice is to connect the neutral points of all current transformers in an interconnected group to a common bus and ground this bus at only one point.

Following a luncheon meeting, which was addressed by B. J. Dasher, director of the School of Electrical Engineering, Georgia Institute of Technology, the conference returned for an afternoon session devoted entirely to a symposium on relay test equipment. R. J. Cooper, Georgia Power Co., presided over the symposium.

This session included discussions and demonstrations of test equipment by C. M. Gadsden, Duke Power Co., C. R. Goodroe, Tennessee Valley Authority; H. M. Hicks, Jr., Alabama Power Co.; J. C. Huffer, Florida Power Corp.; L. T. Shivers, Gulf Power Co.; and B. E. Smith, Virginia Electric & Power Co.

Test sets described

C. M. Gadsden, of Duke Power Co., described and demonstrated a portable general purpose relay test set. This basic unit, with suitable additional equipment and connections, can be used for testing a wide range of relay schemes, such as overcurrent, overvoltage, undervoltage, reclosing of oil circuit breakers, frequency, direct current timers, and distance relay schemes.

Mr. Gadsden pointed out that the set is readily portable and easily adapted to various testing procedures, making it a most convenient tool for field relay test work.

Another general relay test set was described and demonstrated by C. R. Goodroe, of the Tennessee Valley Authority. This test set consisted of three components: a control panel, a variable voltage autotransformer, and a loading transformer. The combined weight of the three components totaled 77 lbs.

While this test set consists basically of a source of test current and a means for measuring the relay operating time, it includes a number of special features and circuits which enables the tester to perform a wide range of relay tests.

H. M. Hicks, Jr., of Alabama Power Co., reported that his company has two types of test kits in operation, one called an overcurrent kit, and the other a distance relay test kit. He described in detail the distance relay test kit which included a main unit consisting of panel-mounted switches, auxiliary relays, two powerstats, a carbon pile, and terminals for all the test leads. In addition to the main unit, the distance relay test kit includes a voltmeter, ammeter, cycle counter, phase angle meter, load box, and phase shifter.

To test a distance relay with this outfit, Mr. Hicks explained, the current is first adjusted to approximately its test value (usually 20 amperes for first and second zones and less for the third zone). The three phase-to-phase voltages are balanced and adjusted to a value high enough to give a steady phase angle meter reading, usually 110 volts. With the phase shifter, the proper phase angle between the voltage and current is obtained. The current is then adjusted to its exact test value. By means of

J. W. Mason, left, dean of engineering for Georgia Institute of Tech., welcomed the relay specialists to the conference. H. P. Peters, Tech Engineering Experiment Station, presided over the opening session.

Dr. W. J. McKune
Ga. Tech.

J. C. Huffer
Fla. Power Corp.

C. L. Headley
Balt. Gas & Elec.

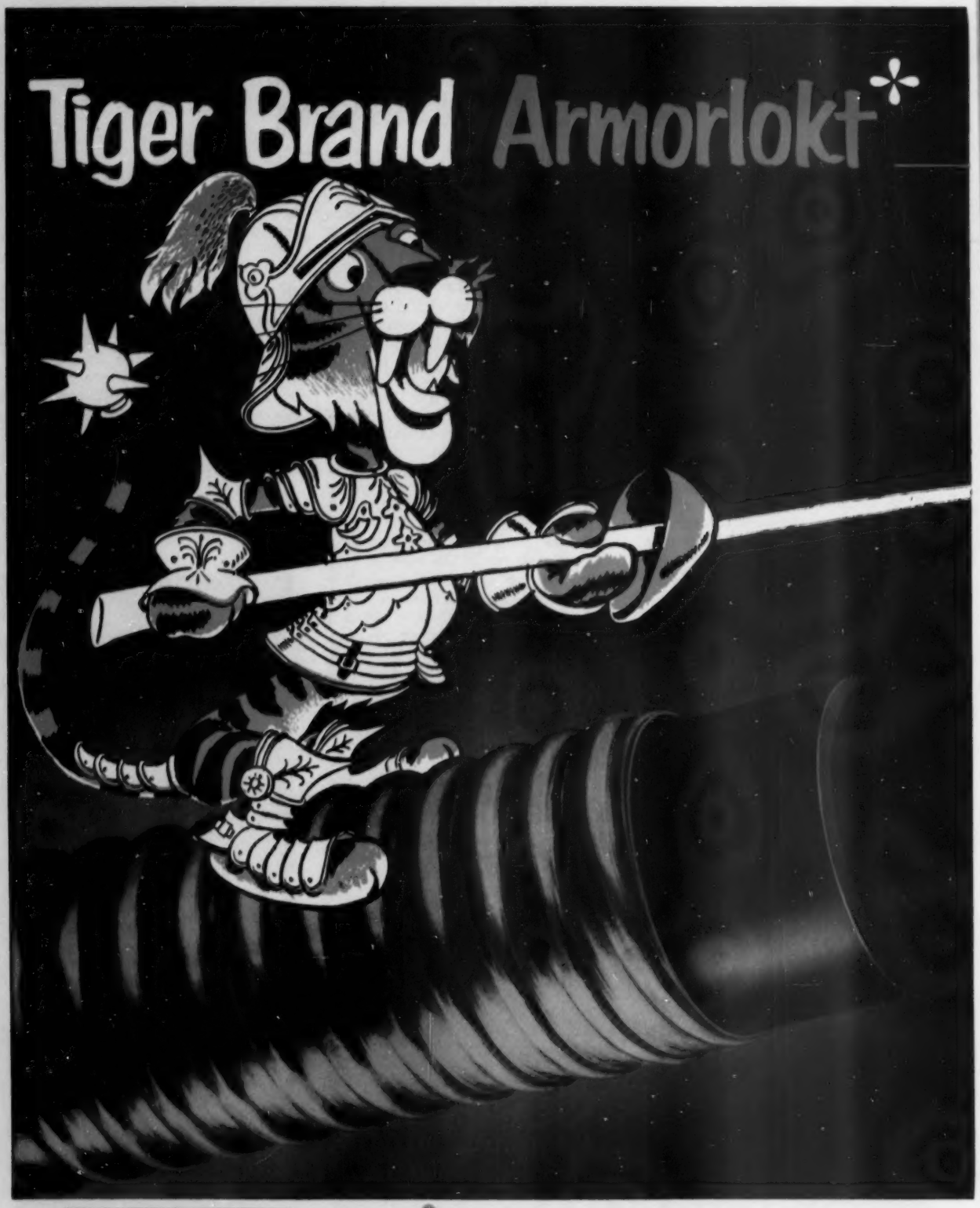
Jerry Vandermere
Ala. Power Co.

Lewis Butt
Fla. Pow & Light

E. T. Wadsworth, Jr.
TVA

J. M. Pinkerton
Nashville Elec.

E. B. Henry
Gulf Power Co.



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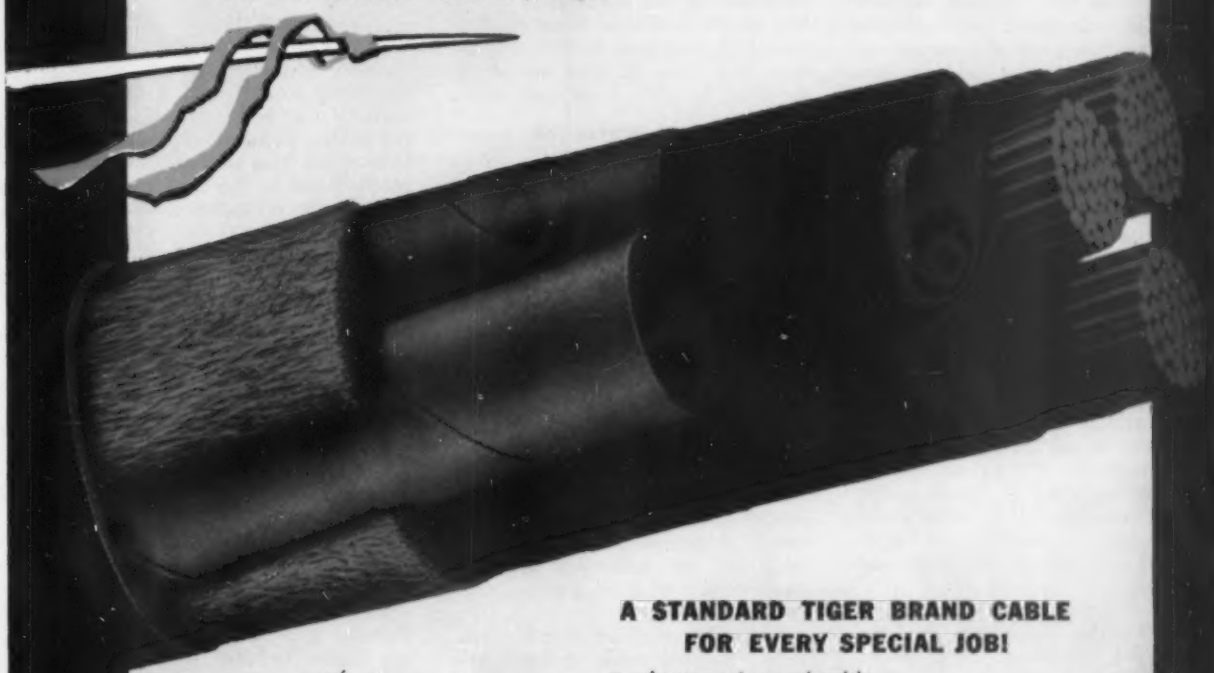

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the powerstats, the voltage is lowered until the exact operating point is found.

J. C. Huffer, of Florida Power Corp., described a relay test load unit utilized by his company. The load unit was built with commercially available materials and is capable of smooth variable output of 0-50 amperes alternating current on low impedance circuits. For high impedance circuits which require using current direct from the variac, the unit is limited to 15 amperes for short periods, or 5 amperes continuous duty. The test leads and switches incorporated in the unit facilitate rapid testing of relays.

An interesting relay testing unit was described by L. T. Shivers, of Gulf Power Co. This test box was originally designed to facilitate testing of directional distance relays. However, by adding two terminals and a switch, the design was adapted to testing the directional ground relay associated with distance relays without disturbing the test setup. Thus, the test box could also be used to test the usual overcurrent relays, as well.

The test box mainly provides the terminals and circuits for performing the tests, and additional equipment is required for testing various types of relays. For example, to test overcurrent relays, a timer, an ammeter, and a load box are required in addition to the test box itself. For testing directional distance relays, a phase angle meter, voltmeter, phase shifter and variac will be required in addition to the timer, ammeter, and load box.

Mr. Shivers reported that this test box has greatly facilitated the testing of directional distance and overcurrent relays on the Gulf Power system. Its compact size, lightness, and ease of connection has decreased the time necessary to set up a test. It has reduced the number of mistakes in wiring and the "wear and tear" on the relay tester.

Phase shifters built

The final contribution to the symposium on relay test equipment was presented by B. E. Smith, of Virginia Electric & Power Co. He reported that his company has five relay test crews, four of which are qualified to test all types of relays. Each of these four crews is outfitted with all the equipment necessary to test any relay in the system with the possible exception of a few rare and unusual relays that require special equipment.

He reported that the cost of test equipment per crew was reduced to some extent by building homemade phase shifters utilizing variable voltage autotransformers. The cost of the homemade unit was approximately one-half of the cost of commercially available phase shifters. He said that two years of use had indicated that these homemade phase shifters had the advantages of low cost, low weight, easy to handle, rugged in construction, and were designed in such a way that the variable voltage autotransformer could be used separately.

In spite of some minor disadvantages of the homemade units, Mr. Smith said that their experience had been such that in the future this type of unit would be supplied to each new test crew.

Backup protection

The first speaker of the second morning session, over which M. C. Johnson, of South Carolina Electric and Gas Co., presided, was A. J. McConnell, of General Electric Co., who presented a comprehensive discussion of "Backup Protection." Mr. McConnell said that as systems increase in complexity, and service requirements become more stringent, backup protection will become even more important in system protection planning. There will be increasing numbers of system locations where present backup relaying will become inadequate and an improved form will be necessary for the maintenance of good service continuity.

By means of slides, Mr. McConnell presented some specific examples of backup problems and some of the possible solutions. These included backup protection for transmission lines, busses, generators, and transformers.

He said that first-class backup protection for tomorrow's systems will require close co-operation today between system planning and system protection personnel. Among current trends in backup protection are: more careful scrutiny of backup protection to avoid blind spots upon the failure of an element of the protective system; use of faster backup protection; a trend toward local, rather than remote, backup protection thus providing protection that is free from the effects of system changes; and consideration of backup protection in the early planning stages of system construction.

"Controlled Ground Fault Protection Applied to Three-Phase, Four-Wire Distribution Circuits," was the subject of a paper presented by M. F. Hebb, Jr., of Florida Power Corp. The paper was prepared in co-operation with J. T. Logan, consulting engineer, of St. Petersburg, Florida.

Mr. Hebb reviewed the problems associated with the application of ground fault relay protection to three-phase, four-wire circuits, but said that out of necessity his company had adopted the practice as standard about three years ago and that it has now been applied to about 95 per cent of all their 4 kv and 12 kv distribution circuits.

The method they have used, he said, has been so successful that the number of feeder tripouts to date resulting from unbalanced phase loading has been negligible with no feeder lockouts attributable to this cause. The advantage of their method lies in the coordination of Type ACR reclosers with branch line fuses.

Blocking system used

In substance, the reclosing relay cuts off the ground relay for a predetermined time, generally five seconds, concurrent with the first reclosure. This practice restores fuse and other protective device coordination with the induction element of the phase relays, thereby permitting restoration of service to the trunk circuit for failures involving branch lines. At the end of this period the ground relay protection is restored by the reclosing relay, thereby providing for retripping the feeder breaker should a conductor be permanently grounded and not cleared by other protective devices.

A comprehensive discussion of automatic reclosing schemes was presented by Edwin T. Wadsworth, Jr., of Tennessee Valley Authority. He pointed out that the TVA system has a wide variety of reclosure schemes, and that this is primarily due to the complexity of the system with many special operating requirements. The picture is further complicated by the wide range of operating voltages.

He reported that automatic reclosing coordinated with automatic sectionalizing air break switches has been used with very satisfactory results. This scheme permits

(Continued on page 103)

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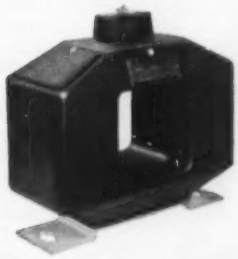
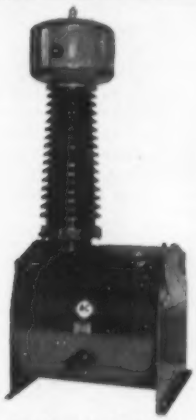
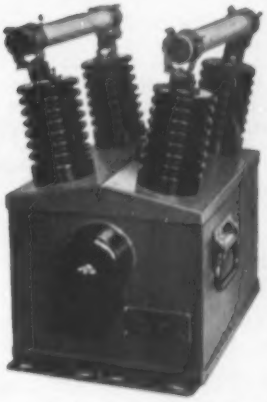
Oil-insulated outdoor current transformer, type SCW for 25 kv to 138 kv.



Molded current transformers, type BKM for 2000, 3000 and 4000 ampere application, 600 volts.



Oil-insulated outdoor potential transformer, type SPW for 25 kv to 138 kv.



Indoor potential transformer, type PD, rated up to 14,400 volts, fused or unfused.

A-4958

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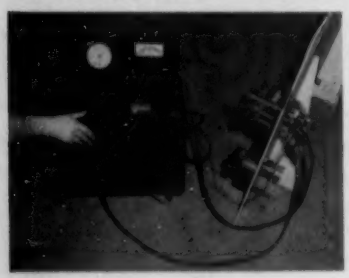
Notes on new utility equipment

Induction disc relay tester maintains good wave form

A PORTABLE induction disc relay test instrument providing high current and continuously adjustable voltages for testing and calibrating protective relays, current transformers and related devices has been introduced by Multi-Amp Corp., 10 Third Street, Newark, N. J.

Multi-Amp Model IDR 35/1 consists of an autotransformer, an output transformer, and a tapped series reactor in its output circuit. The low-voltage adjustable d-c output tests



relay target and seal-in units or similar d-c devices, and an indicating lamp checks contact action.

The 2 kva Model IDR 35/1 is accurately adjustable in stepless increments through the duty ranges of 0-80 volts at 0-25 amperes and 0-10 volts at 0-200 amperes.

The unit is 17" high, 20" wide and 12¼" deep; net weight; 80 lbs. The Multi-Amp IDR 35/1 is a compact and simple answer to protective relay and current transformer testing where good waveform and test results identical with manufacturers' are desired.

Portable interrupter device now ready for production

FOLLOWING SEVERAL years of engineering development in the S&C Electric Company laboratories and more than two years of experimentation and field trials, a portable interrupting device, the load interrupter tool, has been pronounced ready for production by John Conrad, company president. The tooling-up program is already underway and the company expects to announce production models in the near future.

The load interrupter tool is a portable device which may be attached quickly and easily to an open type distribution cutout or a distribution disconnect to convert it temporarily into a load interrupter. Following use for load switching it is detached for immediate use elsewhere.

The load interrupter tool will have a nominal voltage rating of 15 kv, according to the Chicago manufacturer. It will interrupt safely any load current of 400 amperes, or less, at any system voltage from 2,300 through 14,400 volts. It may be used on primaries of distribution transformers, at sectionalizing points, or for capacitor switching. Because of its durable construction, the manufacturer predicts that the device will withstand daily field usage. However, should maintenance be required, stocked subassemblies will facilitate immediate on-the-job replacement of parts.

Additional information can be obtained by writing S&C Electric Co., 4434 N. Ravenswood Ave., Chicago 40, Ill.

Fuse cutout design features fiberglass reinforced tube

A COMPLETELY NEW heavy duty distribution fuse cutout, which for the first time in the industry uses a fiberglass reinforced fuse tube, is being placed in production by Hubbard and Co., 5401 West Roosevelt Rd., Chicago 50, Ill.

A. C. Westrom, director of research and development at Hubbard's Chicago plant, said the new cutout is an open type, drop out and includes design features recommended in a survey of electric utility distribution en-

gineers. All development, including electrical tests, was performed in Hubbard's expanded research laboratories in Chicago.

"Greater strength of fiberglass over the phenolic resins used in the past enables us to provide a small bore in a single vented fuse tube, resulting in faster and more positive interruption of both low and high currents," Mr. Westrom said.

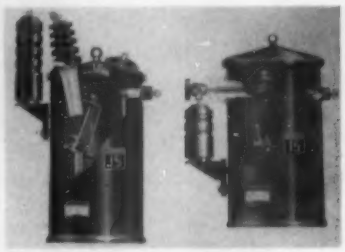
Another feature of the new product is a looped lower recoil absorber that minimizes the mechanical stress to all parts. A sleet hood as well as complete bird proofing will be included as standard equipment on the cutout. The cutout is equipped with transformer terminal type of connectors for both line and load terminals. The lower hinge control includes a cam locking device that makes hot stick servicing easier.

Hubbard will manufacture the new cutout in a full line of heavy duty ratings.

Improved transformer line features easy installation

AN IMPROVED LINE of distribution transformers has been announced by the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. The new transformers feature simplified installation and maintenance and new load management tools.

These transformers will be built in single-phase ratings from 3 to 167



kva, 15 kv, and below. Three-phase ratings will range from 9 to 150 kva, 15 kv, and below.

Key feature available for use with the conventional line is a new overload indicator that keeps a permanent and accurate record of total overload hours based on copper temperatures. This feature aids in prediction of transformer life, gives advance warning for change-out scheduling, and is easy to read from the ground.

In the CSP line, the main feature is higher breaker trip settings. The higher settings will boost normal operating range of the transformers by about 20 per cent, without sacrifice in service life. Emergency overload settings are boosted by about 15 per cent. Also, a new method of mounting the protective link in CSP transformers (5 kv and below) is used to permit replacing the link in the field.

The 7200- and 7620-volt distribu-

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tion transformers in ratings from 25 through 50 kva are shorter. Height of the 25-kva unit has been reduced to permit it to replace a 15 kva on existing poles, while the 37½ and 50-kva units have been shortened to make these ratings interchangeable with an existing 25-kva unit on change-out.

The nameplate is larger, to improve readability in the shop or on the pole. The kva stencil, formerly applied by painting, is now on a metal decal. The marking is not only easier to read, but also has a longer life.

The main cover bolt in the 3 through 50 kva ratings will have a lifting eye that permits the transformer to be hoisted into place without lifting slings.

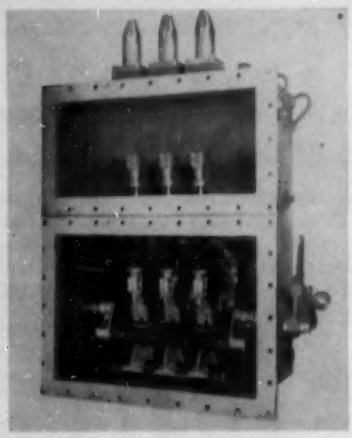
All bushings on the new transformers will have threaded porcelains, giving an improved mechanical assembly, better gasket retention, and improved seal.

A new light-weight, weatherproof polyethylene plastic bird and animal guard is available for the high-voltage cover bushings. This snaps into place over the top skirt of the bushings.

Primary grounding switch offers special features

TYPE "RA" 15000 volt 400 ampere subway style switch for bolting or welding to any make of network transformer is used for connecting, disconnecting or grounding the feed cables.

With different lengths of contacts (bottom) the three phases A, B and C can be grounded separately in sequence. Furnished with or without



electrical interlocks. All contacts are silver plated. The rocker arm link strap is "Permali," a resin impregnated laminated wood. Switches are made for filling with oil or with Askarel.

Complete information may be obtained by writing the manufacturer, G & W Electric Specialty Co., 7780 Dante Street, Chicago 19, Ill.

Automatic light control eliminates photo-tube

ALTHOUGH INTERCHANGEABLE with Lumatrol Model "A", and incorporating the same convenient plug-in-out design adaptable to any make luminaire, the new Model "S" manufactured by Micro Balancing Inc., Garden City Park, N. Y., offers several startling advances in light control for street and highway installation.

A novel departure from conventional circuitry for this type device is the elimination of the photo-tube. Instead the unit utilizes a light sensitive cadmium sulfide cell, said to have infinite life and minimum sen-

sitivity to atmospheric changes. The C/S cell provides the means which results in an exceptionally stable, low impedance circuit, not possible to attain when the photo-tube is used.

Of special interest to those concerned with fully automatic street lighting control is the completely omni-directional light sensing characteristic of the Model "S". Accurately sensing the mean light level, regardless of obstructions, shadows or compass direction, the unit needs absolutely no orientation. The Model "S" is said to be the smallest, most compact fully automatic light control.

Small, light-weight design for new Type CVH regulator

SOLA ELECTRIC CO., 4633 West 16th St., Chicago, manufacturer of constant voltage transformers and fluorescent lighting ballasts, announces an important design improvement of their Type CVH harmonic-neutralized constant voltage transformers in three capacities. Prime advantages of the new Type CVH regulator design are smaller size and lighter weight. Size is reduced up to 60%; and weight as much as 54%. Also, the new design offers greatly-reduced external field — far lower than any other stock, static-magnetic voltage regulator available.

Minimized size and weight result from redesign of the main core-and-coil assembly so as to eliminate the separate neutralizer component. This, in turn, permits use of a simple, single, rectangular housing assembly in place of the two-unit assembly formerly used on larger sizes.

Essentially, electrical characteristics of the new Type CVH stabilizer are unchanged. Regulation is ±1%

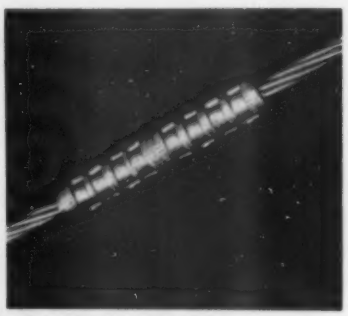
over a newly-expanded primary voltage range of 95 to 130 volts. Sinusoidal output is delivered with less than 3% harmonic distortion at rated load. The Sola harmonic-neutralized constant voltage transformer may be used for the most exacting applications with equipment having elements which are sensitive to power frequencies harmonically related to the fundamental. It is especially suitable for input to a rectifier when close regulation of the d-c output is required.

The new Sola Type CVH design provides labeled input and output terminals on a panel within the outlet box at one end of the assembly. It is finished in gray hammerloid. Three capacities are available — 250, 500, and 1000va.

New Burndy Hysplice for AAAC conductor

BURNDY Engineering Company, Norwalk, Conn., has designed and developed full-tension, one-piece Hysplices for all sizes of the all-aluminum alloy conductor (AAAC) recently placed on the market.

Standard Burndy tooling is used for the new line of Hysplices (Cat. No. YDS-LT). Construction is of heavy-wall aluminum tubing. All splices have knurled guide marks for



exact crimping, index number for rapid tooling identification, are factory capped and filled with Penetrox, Burndy's oxide preventative and corrosion inhibitor compound.

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NECA, Rio Grande Valley Chapter. R. N. Cummings, Manager, 607 West 4th St., Weslaco, Tex.

NECA, Virginia Chapter. Richard R. Smouse, Manager, 203 Roslyn Hills Dr., Richmond 26, Va.

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IAEI, Kentucky Chapter. E. H. Rueppel, Secretary-Treasurer, 201 Citizens Bldg., Louisville 2, Ky.

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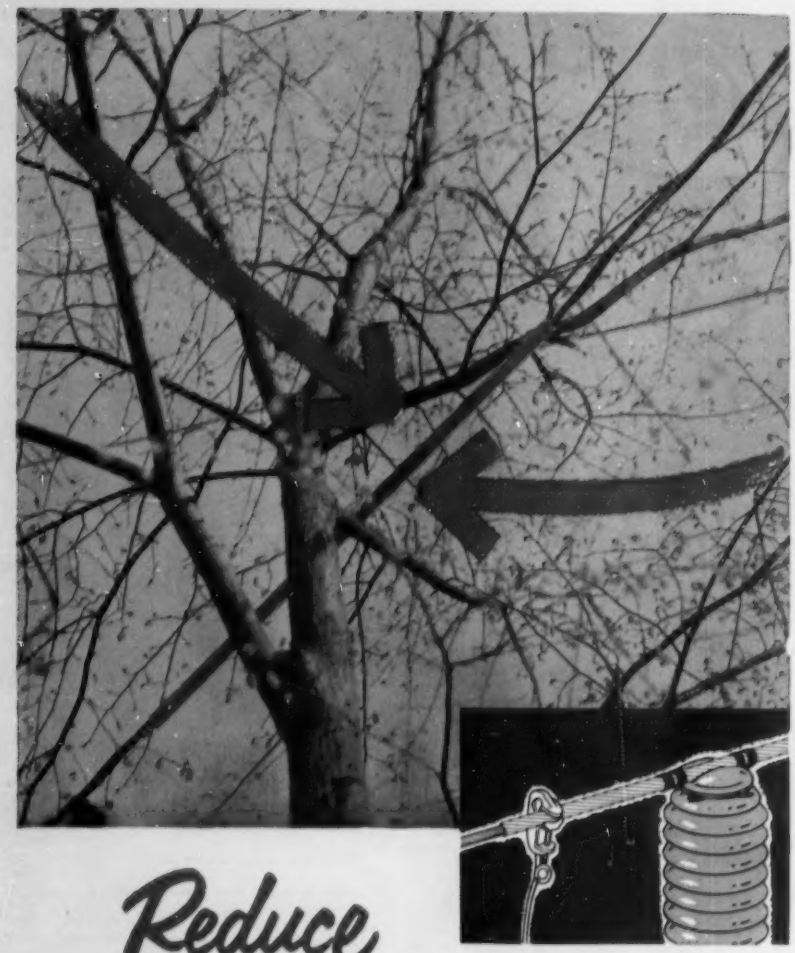

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Reduce maintenance expense . . . improve customer good-will by protecting your conductor with Preformed Line Guards. Metal or plastic guards available...all are accurately formed to fit snugly without loosening. Easy to install—no tools needed.

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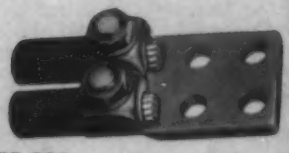
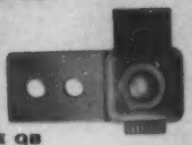


TYPE Q2A

TYPE QA-90

TYPE QQA



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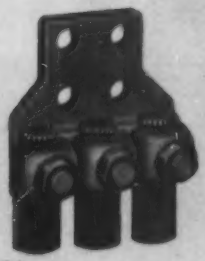

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Popular sizes in stock to meet your individual requirements.

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News of the industry

edited for Southern readers

Business theme of NAED convention

THE NATIONAL Association of Electrical Distributors, meeting for its 48th annual convention in the Ambassador and Chelsea Hotels in Atlantic City, June 10 to 14, will hear speakers discuss a variety of problems close to their hearts and pocketbooks, under the convention theme, "Let's Talk Business."

Convention headliners will be Raymond Rodgers, professor of banking in the Graduate School of Business Administration of New York University; P. Howard Farley, sales promotion manager of the National Electrical Contractors Association; J. Q. du Pont, administrative assistant in the Public Relations Department of E. I. du Pont de Nemours & Co.; and Frank Rockwell Barnett, director of research, The Richardson Foundation, Inc.

In addition to formal talks delivered before the convention, there will be special illustrated presentations on the NAED program. Headlining these will be a slide-and-live presentation covering the "Ten Steps to Better Distribution"; a "Minute Man" panel on committee work that will feature the chairmen of NAED commodity and general committees answering questions on specific programs of each committee; and a presentation on the industry program, "Live Better—Electrically."

A new addition to the convention program this year is the "NAED Theatre," which will present a cycle of four films dealing with various opportunities for improvement in the electrical industry and related fields.

The convention meetings will take place in the Chelsea Hotel; the conference booth sessions and registrations will be held at the Ambassador Hotel.

Increase predicted for power industry

THE NATION'S electric power industry may well be called on for a 123 per cent increase in output in the next ten years, according to Ralph J. Cordiner, president of General Electric.

Mr. Cordiner told General Electric share owners at the company's annual meeting that the nation's power consumption in 1966 is expected to reach 1.5 trillion kilowatt-hours, as compared with an estimated 680 billion for 1956, and 307 billion in 1947.

He described the country's electrical consumption as "one of the best physical measurements of the country's standard of living," and said that "the historic growth rate of the electric power industry, doubling every ten years, has naturally accelerated with the rising standards of living."

"The demand for electric power," he said, "is now expected to double in the next eight years and to quadruple in the next sixteen."

Mr. Cordiner said that all segments of the electrical industry have embarked on a program to educate the public on the opportunities for increased electrical services in the home and that the goal for 1966 is to increase the average home use of electricity 2½ times to a total of 7,500 kilowatt-hours. He noted that electrical energy consumption per residence has already doubled from an average of 1,439 kilowatt-hours in 1947 to nearly 3,000 kilowatt-hours this year.

Citing the importance of research and development as the best guarantee for progress, Mr. Cordiner told the share owners that "it is now a truism that those industries that have spent most on research have gained most in stature." He pointed out that the electrical manufacturing industry accounts for about one-fifth of the private industrial research and development total.

POWER COMPANY WINS AWARD—The George A. Hughes Award for promotion of electric cooking by commercial customers during 1955, sponsored by Hotpoint Company, awarded to Georgia Power Company on the basis of a 72 per cent increase over 1954 in sales of electricity for commercial cooking. Left to right are Ralph T. Layfield, field supervisor, commercial cooking, and C. M. Wallace, Jr., vice-president, sales.

Jurisdictional dispute settled by tradeunions

THE JURISDICTIONAL dispute between the International Brotherhood of Electrical Workers and the United Brotherhood of Carpenters and Joiners of America, as to which union should handle the installation and erection of luminous and acoustical suspended ceilings has finally been settled by an agreement which became effective February 1st and remains in full force for two years.

As a result of this agreement, the installation of typical suspended acoustical ceilings will be the work of members of the United Brotherhood of Carpenters and Joiners.

When electric fixtures are used in connection with such ceilings,

Lighting by DAY-BRITE Lighting Fixtures

makes the big difference . . .

Mr. E. L. Bailey of City Electric Company, Albuquerque, New Mexico.

"Day-Brite fixtures save our time"

The beautiful Simms Building, Albuquerque, New Mexico—one of City Electric's recent jobs.

"When we unpack Day-Brite fixtures, all the parts are there for each and every fixture.

"We don't have to spend time chasing around for missing parts that should have come with the fixture. We don't have any rethreading or recutting to do. Everything fits as it should—gives us a more uniform installation that pleases our customers.

"Naturally, all this saves our time and helps us make a clean profit on the job."

Mr. Bailey is one of hundreds of contractors throughout the country who have good things to say about Day-Brite. The more Day-Brite fixtures *you* install, the more good things *you'll* have to say about them.

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FOR E.M.T. Concrete-tight

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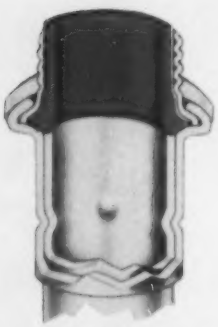

Red Throat
Cross section

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job.

All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

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FOR E.M.T. Rain-tight

SIZES FROM ½" to 2"

SIZES FROM ½" to 2"

SIZES ½" ¾" 1"

SIZES ½" ¾" 1" 1¼"

SIZE ½"

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such as All-Brite Arealiter or Daybrite Mobilex, or other types of fixtures which fit into a grid system, the grid system supporting acoustical tile and electrical fixtures shall be installed by carpenters, providing parallel tees at the two sides of light fixtures support acoustical tile. If additional supports are required for lighting fixtures, they shall be installed by electricians. Electricians shall install all tees and hangers which support lighting fixtures only. Also, electricians shall mechanically secure and ground the fixtures.

When the electric fixture is suspended from the ceiling which in turn forms part of the grid system, as for example Taylor Ceilings, United Lighting and Ceilings Company, and Drive Lok (with electrical raceway built in), electricians shall install all supporting hangers, install electric fixtures, cross members, and wall angle. Carpenters shall install all the acoustical materials involved.

Where the electrical fixture is fastened to the basic ceiling and the light diffuser is suspended on a grid system, electricians shall install the electric fixtures, the grid system, the diffusing panels, hangers, and wall angles necessary to hold the diffusing panels and grid in place. Where acoustical borders or fields are used, carpenters shall install the acoustical tile and such wall angles or hangers as are necessary to support the acoustical border or field. This phase of the agreement would cover the luminous ceiling manufactured by Wakefield, Benjaman, Sylvania, Acusti-Luminous, Smithcraft, and Daybrite.

The agreement signed by the two unions includes fifteen detailed drawings of the various suspension systems involved, and these indicate which trade is to handle the various parts of the work.

AIEE officers named at Raleigh meeting

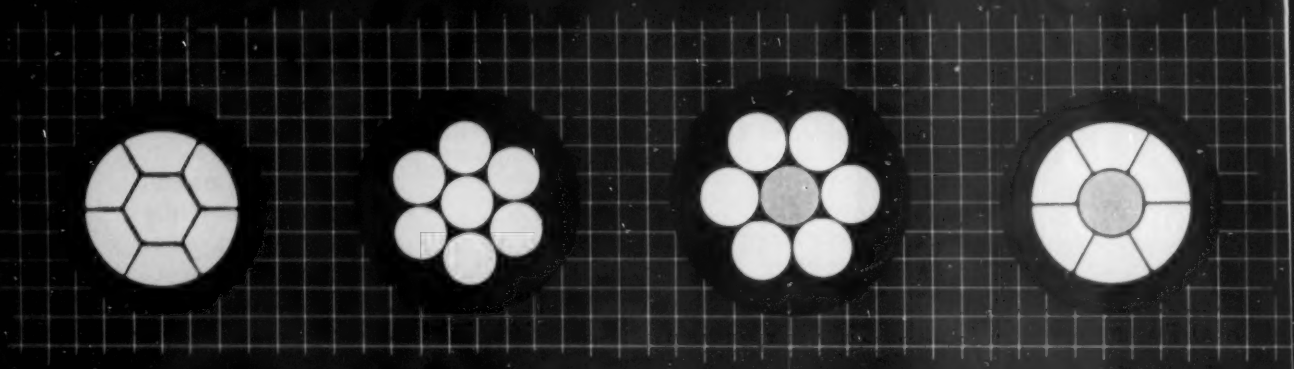
J. C. BREGAR, of Western Electric Company, Winston-Salem, was elected chairman of the North Carolina section of the American Institute of Electrical Engineers at a recent meeting of the organization in Raleigh. He succeeds Kenneth T. Knight, of Raleigh, and served as vice-chairman last year.

Prof. W. D. Stevenson of North Carolina State College, Raleigh, was named vice chairman; and Q. T. Brown of Western Electric Company, Winston-Salem, was elected secretary - treasurer, succeeding Prof. E. W. Winkler of North Carolina State College, Raleigh.

Highway lighting reduces accidents

MODERN LIGHTING, consisting of 322 G-E Form 400 mercury-vapor luminaires, installed by the Southwestern Public Service Company, has helped provide a safer, more systematic flow of traffic for the new highway, part of U.S. Route 66, through Amarillo, Texas. Since the construction of this new six-lane divided thoroughfare, traffic accidents have been reduced 13 per cent while vehicle travel has jumped 280 per cent and speed

This lineup of 322 G-E Form 400 mercury-vapor luminaires on a new six-lane divided thoroughfare in Amarillo, Tex., has helped increase traffic safety. Accidents have been reduced 13% since installation.



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"Compresto* Cable"

"Compresto* Cable" means compressed diameter for the wire strands. Quite noticeable in the above drawings, isn't it? Yet Compresto Cable has the same aluminum area and conductivity, and the same dielectric protection as ordinary cable.

When you buy "Compresto Cable," you can select the covering you want:

1. *Neoprene covering* processed by Western Electric Company's Licensed Improved Room Temperature Method

2. *Polyethelene covering*

3. *Two Coat** rubber insulated, Neoprene jacket*

Be sure to specify Southern Electrical's Superior Quality Control products, identified by the Blue Thread.

You can get Compresto cable on our no-charge, non-returnable reels, or in standard coils or packages to your specifications. Applicable fittings are available.

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CHATTANOOGA, TENNESSEE

"Compresto*Cable"

THE COMPACT COVERED CONDUCTOR THAT WEIGHS LESS...

increases safety factor in ice and wind loadings

WITHOUT ADDED COST

"Compresto*"

is adaptable to self-supporting service drop cable, or weather resistant service wire.

is the result of a special drawing technique that produces a flexible conductor of small diameter, yet maintaining the full aluminum cross-sectional area.

has greater contact surface area for standard connectors, assuring full physical and electrical properties, affording the ultimate in resistance to installation damage, abrasion, compression cutting.

eliminates the voids of an ordinary stranded conductor, reducing the weight without reducing the insulated wall thickness.

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ALSO 20 DIFFERENT OTHER DUPLEX RECEPTACLES

When installation will expose receptacles to weather, moisture, acid fumes, etc., Arrow-Hart's new line of quality duplex receptacles will fill the need . . . up to 20 types complete with unique weatherproof plates. Plate is cast aluminum with a spring lift-lid cover. A rubber gasket seals the cover when closed; a rubber mat under plate makes a weatherproof seal between box opening and building wall. Write for Catalog Data.

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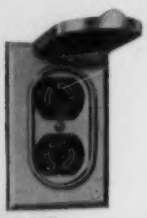
XT-7580-WP



COMBINATION DUPLEX GROUNDING TYPE

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XT-7540 WP

SPECIFICATION GRADE, TWO-WIRE TYPE

1913-WP

400-WP

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Quality WIRING DEVICES • MOTOR CONTROLS • ENCLOSED SWITCHES • APPLIANCE SWITCHES

has increased 22 per cent.

First-year statistics show that accidents have been reduced from 333 on the old two-lane street — which was lighted by enclosed type incandescent luminaires mounted at intersections — to 289 on the new thoroughfare. Traffic now moves at average of 38 mph compared to the previous high of 31 mph; and vehicle traffic has increased from 8928 to 25,000 units per 24-hour period.

Florida city rejects municipal ownership

IN A HOTLY contested election, the voters of Lake City, Florida, rejected by an almost 3 to 1 majority a proposal that the city take over municipal ownership and operation of Florida Power & Light Company's electric service facilities. The proposal, estimated to cost $3 to $5 million, included construction of a city-owned diesel generating plant.

Advocates of the plan waged an intensive campaign on the theory that a city-owned utility would pay no taxes and, therefore, would prove a good money-maker. Strong opposition was voiced by a Citizen's Committee of some 60 business and civic leaders, who opposed it as a step toward socialization.

The opposition to municipal ownership, spearheaded by the Citizens' Committee, centered around the uncertainty of electric rates since the advocates proposed continuing the company's present rates. Furthermore, rate regulation under municipal ownership does not exist in Florida, which meant there would be no protection against rate increases.

Another objection was that a small city plant could not provide dependable service and might even become obsolete in a few years with atomic power developments.

Durham inspector plans retirement

C. S. WHITAKER, city electrical inspector at Durham, N. C., for the past 43 years, has announced plans to retire July 1. His successor has not been named.

Durham has had only one other electrical inspector, the late Jarvis Gooch serving two years before Mr. Whitaker took over the post. C. O. Mullen has been his assistant for several years.

Both Mayor E. J. Evans and City Manager R. W. Flack expressed regret at Whitaker's decision to retire, the mayor terming him "one of the most able department heads in our municipal family."

"It is seldom that a man can

C. S. Whitaker, city electrical inspector at Durham, N. C., for 43 years, plans to retire July 1.

render 43 years of outstanding service and at all times keep the respect of the community, the contractors, and workmen who follow his recommendations in the enforcement of the city's electrical code," said Mayor Evans.

"For many years to come practically every building in Durham and most of the homes will contain momentoes of his skillful supervision. His is the kind of service that makes municipal activity a rewarding occupation in our community life."

Industry groups oppose TVA bond financing

KEY LABOR and business groups have now taken a stand against proposals to allow the Tennessee Valley Authority to finance further expansion through revenue bonds rather than through Congressional appropriations as at present. Several bills to carry out these proposals are now before Congressional committees.

The Utility Workers Union of America said that "In effect, the proposed TVA public bond offering would serve, in so far as the organized employees of the utility industry are concerned, as a method by which their money would be used to push themselves out of a job."

The union asserted that "If permitted, that device would remove any limit to the amount of 'cheap' power it (TVA) could offer to industries outside its area through continued tax exemptions, billions of dollars of hidden initial costs, and questionable bookkeeping in the allocation of operating costs."

SMALLEST in SIZE
BIGGEST in FEATURES

15 AMPERE — 120 VOLT AC ONLY
LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES

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Junior Quiette SWITCHES

SCREW OR SCREWLESS TERMINALS

You'll like the Junior Quiette Switch for its small size that means ample wiring room . . . for the built-in shunts in some models that eliminate splicing . . . and a choice of either Binding Screw or Screwless Wire-Lock Terminals, as you prefer.

And when you add to these time-saving and money-saving advantages, features like noiseless operation, silver alloy contacts, an "L" rating for 15 amperes, 120 volts, you'll agree A-H Junior Quiette Switches are a must on the next job . . . and all jobs to follow.

Available in single pole, double pole, 3-way and 4-way with Ivorylite or Brown handles. Listed as standard by Underwriters' Laboratories.

Write for free folder (Form A-198), "A-H Quiette Switches Meet Every Lighting Requirement."

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The Council of State Chambers of Commerce charged that under the bond proposals, TVA would remove itself from Congressional control and be able to expand in any direction it should choose, "including an extension of its activities into areas now served by taxpaying private companies." Furthermore, the Council said, the revenue bond proposals would bypass the Treasury Department and "distort the true picture of the entire government's fiscal operations."

The Council said that TVA has no "mandate" to continue expanding indefinitely. Increasing power needs for the area could be met by encouraging the cities of Chattanooga, Knoxville, Memphis, and Nashville to build their own power plants as the city of Memphis plans to do. Large industrial consumers, who take 14 percent of TVA's power, could generate their own. These two measures, according to the Council, would relieve TVA of 29 percent of its present demand.

As a further measure, the Council urged elimination of the "taxpayer-financed subsidy" in TVA rates by requiring the Authority to pay full local, state and federal taxes on the same basis as the electric utility companies, and to pay fair interest on the amount invested in it by the taxpayers.

Distributors attend regional meetings

DELEGATES representing over 100 electrical wholesale distributing companies in Alabama, Georgia, Virginia, Maryland, Washington, D. C., and North and South Carolina — all members of the National Association of Electrical Distributors — met in regional meetings recently to chart progress made in association programs and to air special problems of local bussinesses.

Delegates representing 30 distributing companies in Alabama and Georgia met in Birmingham, Ala. Chairman of the all-day meeting was John W. Shealy, Shealy Electrical Wholesalers, Inc., Greenville, S. C.

The meeting of the Virginia, Washington, D. C., and Baltimore, Md., group, representing 30 distributors, was held in Roanoke, Va. Chairman of the meeting was C. P. Andrew, Noland Co., Inc., Newport News, Va.

Some 45 distributing companies in North and South Carolina, and Augusta and Savannah, Ga., were represented at the regional meeting in Columbia, S. C. W. L. Perry, of Perry-Mann Electric Co., Columbia, was chairman of the all-day meeting.

Thomas F. Preston, secretary-field activities, NAED, discussed "Management and Survival of Electrical Wholesaling," at each meeting. The talk was based on a recent report produced for the membership by the NAED Operating Cost Committee on the available guides to profitable management.

Mississippi utility to expand facilities

R. B. WILSON, president of Mississippi Power & Light Company, Jackson, Miss., has announced that the company will build a $25 million steam electric generating plant at Jackson.

In an unprecedented move, immediately after the announcement, Mr. Wilson appeared before the Jackson City Council to ask for a special election in order to submit the move to the will of Jackson voters.

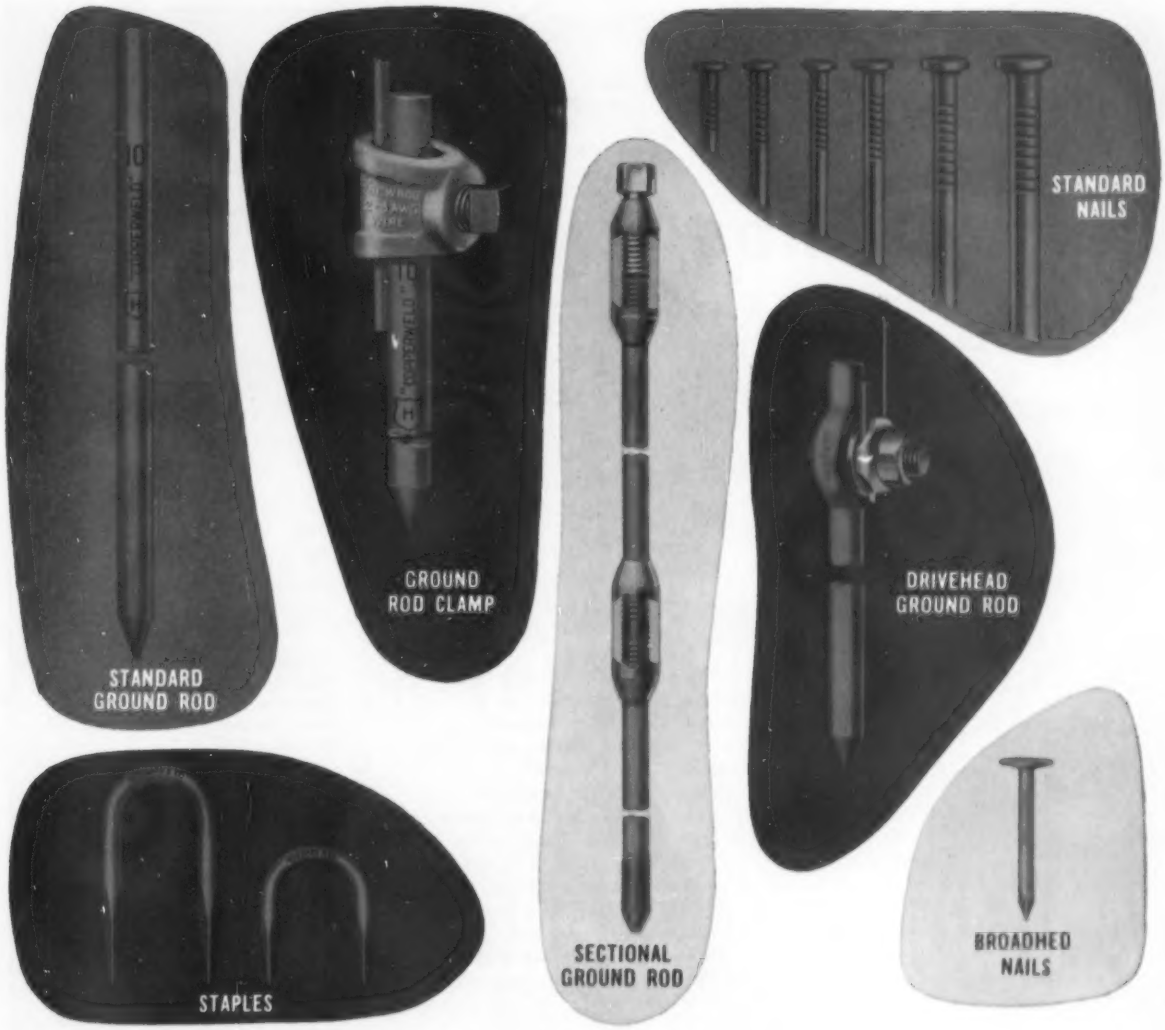
Although, according to the company, a franchise is not needed for operation, a formal request for a franchise has been made, which in turn must be approved by Jacksonians.

Ever since the company first began supplying electric service to Jackson in 1923, it has been operating under certain statutory rights granted by the state legislature. These rights are still ef-

(Continued on page 76)

Lightolier holds Sales Training Clinic for distributors

Salespeople representing electrical distributors in 26 Eastern states gathered in New York City recently for an intensive Sales Training Clinic conducted by Lightolier, Inc. Improved selling methods, newest sales promotion ideas, and new additions to the Lightolier line were reviewed during the two-day meeting.



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Hubbard Copperweld Hardware

When your grounding application calls for the corrosion-proof performance of Copper combined with the strength of Steel, specify Hubbard Copperweld! Ground Rods, Sectional Ground Rods, Drive Head Ground Rods, Ground Wire Clamps, Staples and Nails are formed by the unique Copperweld molten-welding process which welds a uniform, thick sheath of Copper to an alloy Steel Core. From then on, Copperweld performs as if it were a single solid metal, installs easily, gives permanent service under the most adverse conditions of moisture and corrosion.

No matter what your specific hardware requirements call for, there is a Hubbard item especially designed for the job. Hubbard's four thousand items of pole line hardware are the most complete line in the industry. Several basic materials are available to allow you to match specific metal characteristics to individual conditions.

Call your Hubbard Distributor—he's an expert —for helpful answers on how to get the most out of your Pole Line Hardware dollar.

HUBBARD AND COMPANY

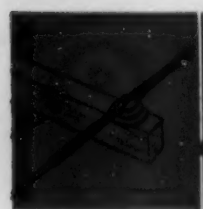
Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Calif.
Dallas (Plano), Texas

FANNER *Superformed* LINEGUARDS

provide lowest cost protection on SHORTSPAN CONDUCTORS

Fanner Superformed LINEGUARDS give short span distribution lines complete protection against abrasion, arcover, or clamp or tie wire damage at lowest possible cost. They have the same features of ease of installation, lasting durability and reuseability as Fanner ARMOR RODS, but are smaller in wire size and shorter, therefore cost far less: It's good economy to use Fanner LINEGUARDS on short spans with low tensions (1) at support points to protect against clamp or tie wire damage, (2) to provide a protective layer for tapping purposes, (3) at expulsion-gap or other critical locations. Further information and prices on FANNER Superformed Lineguards will be furnished on request. Write today.

Other FANNER ELECTRICAL LINE PRODUCTS

ARMOR RODS	PATCH RODS	TAP ARMOR	PLASTIC FANNGUARDS
			
• For protection against vibration damage and also good for emergency repairs on partially broken overhead lines.	• Act as a "repair sleeve" for conductors having up to about ⅓ of the wires broken in the outer layer.	• Provides a protective layer of shortened rods on conductor for making taps without risking damage to conductor.	• Tough, durable spiral wound plastic sleeves that snap together over covered wires and cables to provide protection against free abrasion.

Licensed for use under Patent No. 2,275,019

THE FANNER MANUFACTURING CO.

Electrical Products Division

Brookside Park Established 1894 Cleveland 9, Ohio

AGENTS AND DISTRIBUTORS IN PRINCIPAL CITIES

Dates Ahead

National Association of Electrical Distributors, 48th Annual Convention, Ambassador-Chelsea Hotels, Atlantic City, N. J., June 10-16, 1956.

Public Utilities Accident Prevention Conference, Hotel Roanoke, Roanoke, Va., June 22, 1956.

Virginia Chapter, IAEI, Annual Meeting, Hotel Roanoke, Roanoke, Va., June 25-26, 1956.

American Institute of Electrical Engineers, Summer and Pacific General Meeting, San Francisco, Calif., June 25-29, 1956.

Southeastern Electrical Exchange, Industrial Power Sales Conference, Hotel Roanoke, Roanoke, Va., June 28-29, 1956.

Public Utilities Assn. of the Virginias, 38th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 14-15, 1956.

Maryland Utilities Assn., 32nd Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 14-15, 1956.

National Electrical Contractors Assn., Annual Convention and 2nd National Exposition, Sheraton-Palace Hotel, San Francisco, Calif., Sept. 23-29, 1956.

American Institute of Electrical Engineers, Fall General Meeting, Morrison Hotel, Chicago, Ill., Oct. 1-5, 1956.

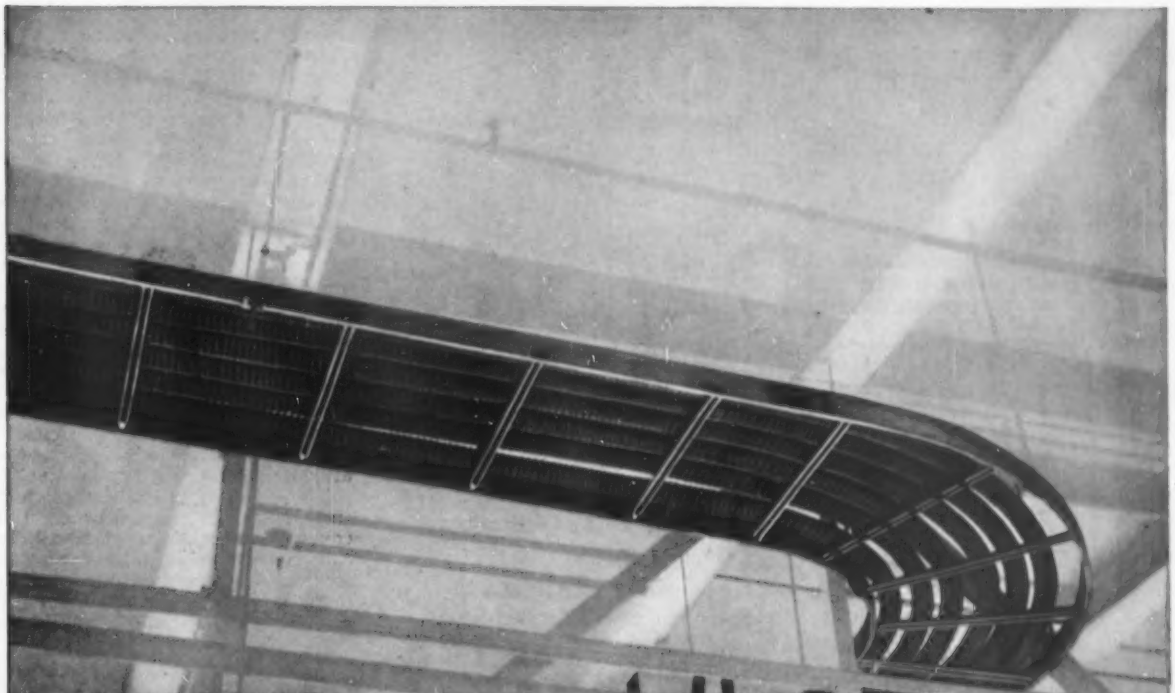
Southeastern Electric Exchange, Sales Section Annual Conference, Tides Hotel, St. Petersburg, Fla., Oct. 3-5, 1956.

Southeastern Electric Exchange, Accounting Section Conference, Miami Beach, Fla., Oct. 11-12, 1956.

International Association of Electrical Inspectors, Southern Section, Annual Meeting, Statler Hilton Hotel, Dallas, Tex., October 22-24, 1956.

Florida Association of Electrical Contractors, Annual Convention and Electrical Exhibits, Balmoral Hotel, Miami Beach, Fla., Oct. 24-27, 1956.

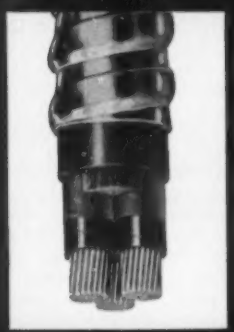
American Institute of Electrical Engineers, Winter Meeting, Hotel Statler, New York, N. Y., Jan. 21-25, 1957.



Installation McKwah Assembly Plant,
Ford Division, Ford Motor Company

INTERLOCKING ARMORED CABLE

SAFE · DEPENDABLE · ECONOMICAL



Modern engineering design and superior flexibility impart *extra long life* to GENERAL CABLE'S INTERLOCKING ARMORED CABLE. Available in ALUMINUM, BRONZE and STEEL TAPE ARMOR, with every type of insulation for all power applications. Lighter weight and easier to install.

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BE SPECIFIC...SPECIFY GENERAL CABLE

fective. However, the need for additional heavy expenditures in electric facilities to meet anticipated load growth in the Jackson area makes it desirable to obtain a vote of confidence in the company through the approval of a new franchise.

The proposed addition to the Jackson Plant would be the largest single expenditure for generating capacity ever made in Mississippi, and would make the existing Rex Brown plant in Jackson one of the largest electric generating plants of its type in the South.

Mr. Wilson said that practically all of the funds needed for the construction of the new generating facility must be raised by the issuance and sale of new securities.

In addition to the ad valorem taxes which will increase with the expansion, provision has been made by the company for payment to the city of Jackson of two percent of the company's residential and commercial revenue, which it is estimated, would provide $7,900,000 to the city during the life of the franchise.

Jackson is the only city in the MP&L territory in which the company operates under a franchise never submitted to the people.

In making its request for a franchise election, MP&L estimated that the peak load of electric energy demand in Jackson during 1956 would be 90,000 kw's. By comparison, it is estimated by the company that by 1960 the peak demand within the city will be approximately 140,000 kw's. The company also estimated that demands of customers will force the expenditure of some $300 million to improve facilities throughout its area by 1970.

According to Mr. Wilson, construction of the new plant at the same site of Rex Brown plant should start the latter part of this year, with completion scheduled sometime in 1959.

Automatic Switch opens new Baltimore office

THE OPENING of a Baltimore office and the appointment of Sidney Dubinsky to the engineering staff of Automatic Switch Company, Orange, N. J., have been announced by John J. Herrity, engineering consultant for the company.

Mr. Dubinsky's past experience as a project engineer with the Bureau of Ships is available in connection with the specification, selection, and application of solenoid valves and electro-magnetic control.

The new Baltimore office is located at 106 Key Highway.

New plant designed for magnetic tapes

A NEW PLANT designed expressly for the manufacture of magnetic recording tape for sound-and-color TV and the amazing new "electronic brain" computers will be built by Orradio Industries, Inc., Opelika, Ala.

Plans for the new $300,000 plant have been announced by John Herbert Orr, president.

The new plant will increase Orradio's production facilities 400 per cent. Construction is scheduled to begin within the next sixty days with the new building expected to be ready for occupancy sometime in October.

"Irish" Brand, the Opelika-produced tape, is now being employed in many highly specialized fields. This magnetic tape is the "memory unit" of "electronic brain" computers, according to Mr. Orr. More than 70 manufacturers are now developing and producing such computers. Magnetic tape plays a vital role in telemetering instruments used to record test data on jet aircraft and guided missiles.

One of the new wonders of electronics — a tape that records both sound and color pictures for TV and movies—will also be produced in the new Opelika plant. This new development is expected to have a profound effect on the television industry within the very near future.

"In the new plant all our tape will be produced in a dust-proof atmosphere," Mr. Orr stated. "All working areas will be air conditioned to control not only temperature and humidity but also dust."

The one-story brick building of fire-resistant construction will cover 37,000 square feet. It will be constructed on a 17-acre tract in Opelika's new industrial development area, 1½ miles south of the city.

More sales push needed, Hooper tells wire group

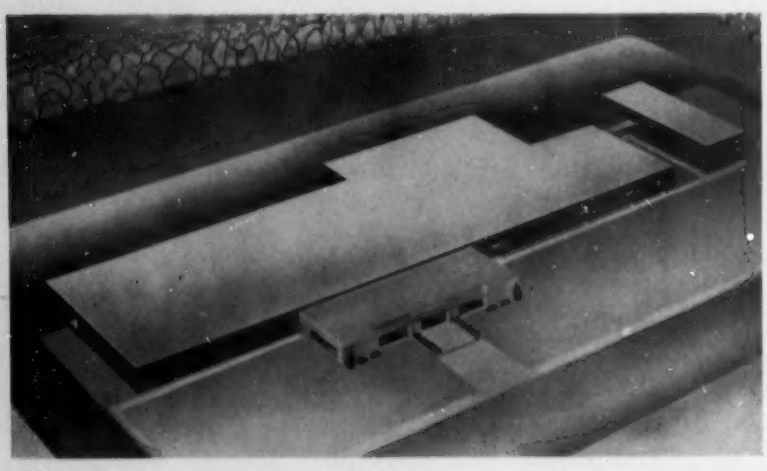
IN MANY MARKETS today, wire has been delegated to the questionable role of serving as a premium to further the sale of other products sold by the electrical distributor.

That was the observation made by Arthur W. Hooper, executive director of the National Association of Electrical Distributors, before the Wire and Cable Section of the National Electrical Manufacturers Association at its meeting at the Westchester Country Club in April.

"The wholesaler's customer buying electrical construction materials today places his order for practically everything needed except the wire," Mr. Hooper said. "Then he proceeds to bargain for the whole package of materials, using the wire as the gimmick, the bonus, the extra lever that's needed to wheel and deal. In turn, the wholesaler must then adopt a similar approach in purchasing his wire requirements from the manufacturer.

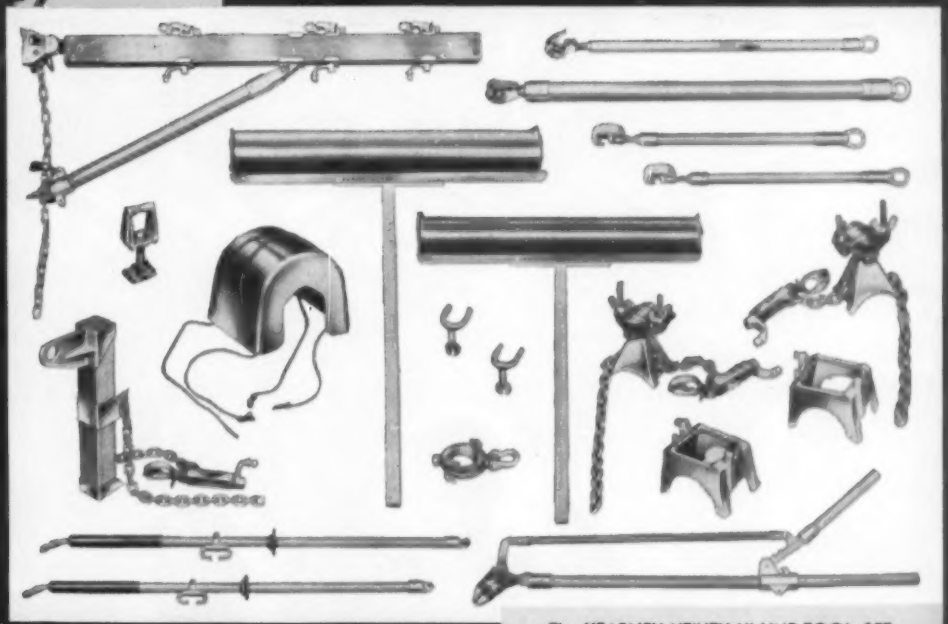
"This," he said, "makes about as much sense to me as it would be for the tobacco industry to commence giving away cigarettes with the purchase of a book of matches."

Mr. Hooper noted the incongruity of this situation in an era marked by the greatest sale of wire products in the history of the industry. He cited as examples the tremendous demand for the product and the urgent need for it as a direct result of many of the programs the entire industry is supporting in its behalf.



Orradio's new plant, at Opelika, Ala., designed expressly for manufacture of magnetic-recording tape for a wide range of applications.

Work hot lines safely...



The KEARNEY UTILITY HI LINE TOOL SET CATALOG No. 4778-6 is especially convenient and efficient for handling distribution work.

WITH KEARNEY Hi-LINE TOOLS

Service interruptions cause customer inconvenience . . . and revenue loss. KEARNEY Hi-Line Tools are designed *for working hot lines safely,* by tool engineers experienced in hot line work.

Each tool is manufactured for specific applications and uses, and must pass rigid tests. This means safety for your crews.

If you have any unusual hot line problem on your system, KEARNEY's skilled field servicemen will be glad to demonstrate Hi Line Tools and help train linemen in their use.

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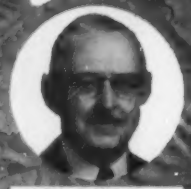

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South Boston 27, Mass.

Jack Riley
4369 Elston
Chicago 30, Illinois

J. R. Schmidt
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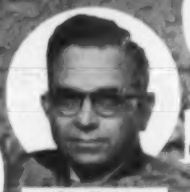
Paul F. Kyack
10 South 18th St.
Philadelphia 3, Pa.

Bob and Bert Brazil
602 W. 28th Street
New York, New York



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Here's the PITCH
for faster, more economical anchoring
CHANCE BLACKFOOT ANCHORS
Can be installed by machine to cut line construction costs
Here's a screw anchor that goes down fast and easy whether your line crews install it by hand or by machine. A king-size thimbleye on the Chance Blackfoot will accommodate a big turning bar for easy hand installation. And when you machine-install a Chance Blackfoot Anchor, you reduce installation time to a minimum—which means a big savings in time and money!
What about holding power? Dynamometer tests on a Chance 15 inch Blackfoot Screw Anchor showed no creep at 22,000 pounds!
SMALLER HUB
Smaller hubs on Chance Screw Anchors mean less friction—easier installation. Less earth is disturbed during installation. That's why the Blackfoot has greater holding power.
PITCH CONTROLLED
This accurately pitched, fast cutting blade really goes down fast. Every size anchor is individually "pitch controlled."
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"ANCHORING" is the most complete guide to anchoring and guying ever developed. It shows how to choose the right anchor for every job—and how to install it right. Send for your copy!
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"What an opportunity your product offers the professional salesman today," Mr. Hooper remarked. "You couldn't ask for a more favorable set of factors for the marketing of your product. Yet, here is a product that they say isn't being sold."

What the industry needs to offset this lack of merchandising, Mr. Hooper declared, is more sales power — at all levels. "We need salesmen who know how to get out and prospect — who know how to create demand and build new markets for their goods. We need salesmen who are ready to provide the right goods at the right time in the right quantity and at a reasonable price.

"I think we've got to build an intelligent, stable sales force for the selling of wire and cable products," he continued. "I think that the footballing of these basic products in our industry will destroy a lot of valuable manpower that is vital for our future success. If the salesman must become a 'deal' man then he soon becomes a poor salesman. Poor salesmen result in poor buying habits for a firm, poor buying leads to poor quality, poor quality often leads firms down the road of irresponsibility in the market place."

The building of an efficient, trained sales force at the wholesale level is the responsibility of the manufacturer and the distributor alike, Mr. Hooper stated. "It is the responsibility of the distributor to find and engage salesmen who have the greatest ability, to offer them adequate incentives and be ready to work with them in gaining a solid position in the territory. It is the responsibility of the manufacturer to provide the tools necessary to do this training job."

New officers elected at NALMC conference

NEW OFFICERS were elected recently when the National Association of Lighting Maintenance Contractors held their third annual conference at Hershey, Pa.

Edward Creed, of Cleveland, is the new president and Herbert Mendelsohn, of Kansas City, will serve as secretary-treasurer. The regional vice presidents for 1956-1957 are: Eastern—Francis Clark, Waterbury, Conn; Southern—Walter Fink, Jr., Atlanta, Ga.; Central—Jerome Gimbel, Chicago, Ill.; Mid-Western—Glen Shatola, Milwaukee, Wis.; and Western—Robert Watson, Denver, Colo.

The NALMCO adjenda included talks by Robert Zahour of Westinghouse, John Holland of Sylvania, and Richard Lundgren of General Electric. Sales and adver-

tising discussion was led by Robert and James Watson. Office procedures were presented by Herbert Mendelsohn. Round table discussions covered personnel, wages, bonus, uniforms and training. Also discussed were group replacement profits and service methods.

A budget was approved for committee expenses and publicity to spread the organization's aims and increase membership was stressed.

Selection of Kansas City was approved as the site for the 1957 conference, to be held during the month of April.

Expansion announced by New Orleans wholesaler

A MAJOR electrical supply center, warehouse, and office are being built by Interstate Electric Company, of New Orleans. The firm, besides operating a large wholesale electrical supply service for industrial, commercial and other installations, also is distributor for major appliances, as well as operating its affiliate chain of Auto-Lec Stores.

The new establishment to be located in the Carrollton section of New Orleans will give the Orleans area a quicker and more efficient service to electrical contractors, industrial plants, commercial customers, and others. It is also expected to help make the New Orleans area one of the largest electrical wholesale centers in the South.

The new facility will be made of concrete and brick. The building will contain 145,000 square feet of floor space, including 22,000 square feet for air-conditioned offices and display rooms. The building will be one-story with a 19-foot ceiling. The entire property covers 160,000 square feet and will have a rail-roading siding to provide smooth flow of merchandise in large quantities. Ample parking for 200 cars, plus loading and expediting facilities will give easy access to customers.

Announcing the ground-breaking for the new $750,000 warehouse and offices of Interstate Electric Co., of New Orleans, are left, Russell L. McCoy, head of the Auto-Lec Stores affiliate, and George C. Howell, Interstate president.

"You serious about wantin' a couple of days off?"

Sales-service firm organized in Atlanta

THE FORMATION of Tri-State Utility Products, with headquarters in Atlanta, has been announced by Stephen J. Flanagan. The main objectives of the firm are engineering and sales services to rural electric co-operatives, municipal electric systems, and electric utility companies in Georgia, Alabama, and Florida.

S. J. Flanagan

Tri-State is distributor for the Allis-Chalmers Manufacturing Co., and represents the J. H. Holan Corp., Griffin, Ga.; USCO Power Equipment Co., Birmingham; R. G. Haley Co., Toledo, Ohio; Brown Wood Preserving Co., Louisville, Ky.; and the System Analyser Corp., Nokomis, Ill.

Mr. Flanagan has had 20 years of operating, sales, and management experience in the utility field, and is a Member of AIEE. His Atlanta offices will be located at 2562 Sharondale Dr.

All Alabama sales will be directed by Joseph D. Brasfield, with offices at 1008 Palmetto St., Birmingham, Ala.

Kaiser designs new conductor packaging

A NEW PACKAGING method for use on large reels of electrical conductor which eliminates regular wood lagging has been designed and perfected by Kaiser Aluminum & Chemical Corporation at its Newark, Ohio, Works.

The new method of protective packaging consists of a three-ply construction consisting of Kraftboard, shock-absorbing material and another layer of Kraftboard. The entire construction is then bound with steel bands. This development is covered by a patent application, the rights to which are owned by Kaiser Aluminum & Chemical Corp.

With the new packaging system, the old method of using 2x4 wood lagging on conductor reels is eliminated. Extensive tests and usage have proved that the new method is advantageous, particularly from the standpoint of eliminating extensive time and labor chores of removing the wood laglining from the reels.

The new padded lagging package has been subjected to severe weathering and traffic conditions. The material exhibits not only corrosion and shock resistance, but its use has shown that the protected cable is kept cleaner than with conventional lagging.

The new packaging material is being used on Kaiser Aluminum 50-inch, 57-inch and 63-inch reels. A spreader bar is suggested when the reel is sling unloaded to eliminate cutting flanges of the reel.

Fibrous layer which will protect conductor against damage.

new! VIRDEN fluorescent fixtures assemble in ⅓ the time

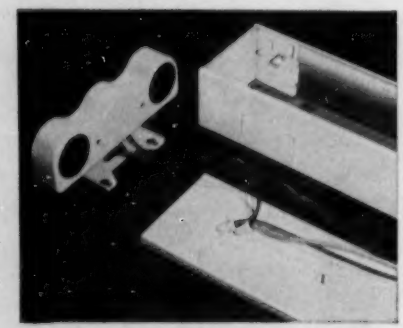
Think of the savings this new improvement in fixture assembly can mean to you. Now you can get and do more jobs—faster.

As shown on the opposite page, lights were fastened to the man's wrists so we could chart the motions needed to assemble the new Virden fixtures and the old-fashioned kind. The pictures show how the new Virden method is smooth and with many fewer motions than the old-fashioned way.

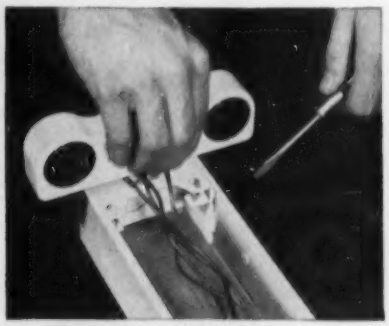
No bag of parts. In just a few minutes, a four-foot fluorescent fixture is ready to be put on the ceiling. No screws to sort out and fit . . . all screws are pre-set, need only tightening. With the Virden system, all the parts fit with a quick click and a turn of the wrist.

Another important feature of these new fixtures is shielding that can be hinged on either side for easy maintenance.

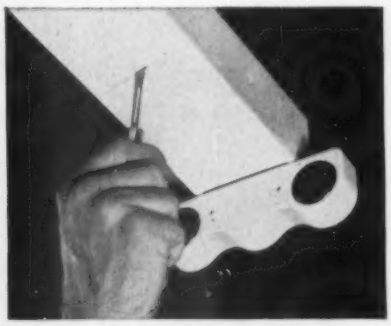
These same time-saving features are on *all* Virden strip, fluorescent and slimline units. Your nearby Virden distributor will show you all these advantages in detail. Next time you need fluorescent fixtures, ask for Virden and see how they make your job quicker, easier, and more profitable. *John C. Virden Co., Dept. ES-4, 6103 Longfellow Avenue, Cleveland 3, Ohio.*



These are all the parts you need to assemble the new Virden fixture. The channel, the sockets and the cover—*no bag of parts.*

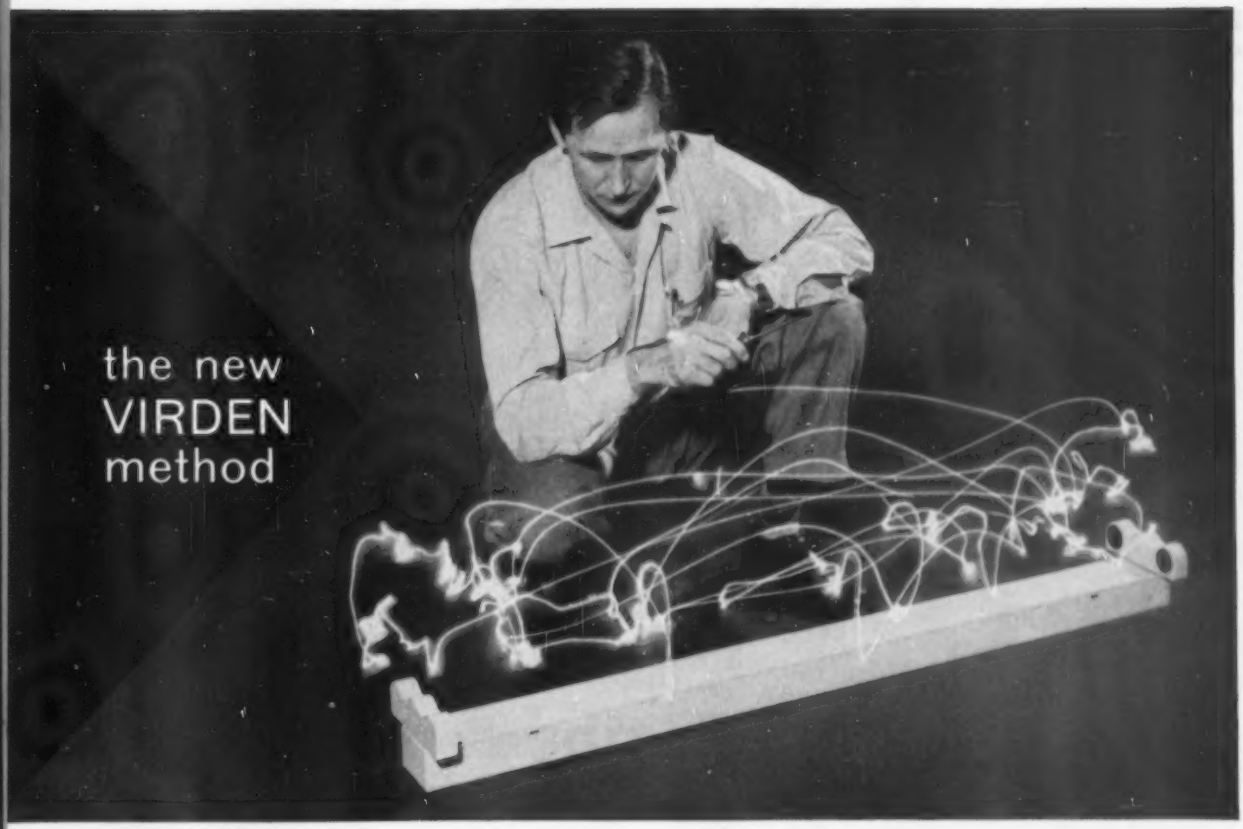


Slip the sockets over the pre-set screws and tighten securely. You are now ready to install the fixture on the ceiling.



When the fixture is mounted, put the cover on, slip the screwdriver in the notch, and give ¼ turn. *In 45 seconds,* everything's assembled.

decorative lighting by virden


the new
VIRDEN
method

the
old-fashioned
way

Brief news notes of manufacturers

R. E. SCHULER, president of Anderson Electric Corporation, formerely Anderson Brass Works, Inc., of Birmingham, Alabama, has announced the change in corporate name.

"Our new name," said Mr. Schuler, "will more closely identify us with the industry we serve and at the same time will be more descriptive of the product we manufacture. The switch from the major emphasis on bronze to a more aluminum-bronze product, lent weight in making our decision."

* * *

THE APPOINTMENT of Stuart E. Yeaton, of Pennington, N. J., an executive of the John A. Roebling's Sons Corp., Trenton, as director of the Copper Division of the Business and Defense Services Administration, U. S. Department of Commerce, has been announced by BDSA Administrator Charles F. Honeywell.

In accepting this appointment, Mr. Yeaton brings to the agency current expert knowledge of the copper industry, with which he has been associated during his entire business career. He will serve without compensation from the Government for a period of some six months, during which he will receive training which will qualify him to serve in any future emergency.

* * *

JOHN H. LAMOTHE, executive vice-president and general manager of the Wheeler Reflector Company, Boston, announces that this nationally-known company is currently celebrating its 75th Anniversary, with the theme "lighting the way to brighter tomorrows."

"We are very proud of the part Wheeler has played in the great advances made by American industry these past 75 years," commented Mr. Lamothe. "Those relatively short 75 years actually encompass the birth, development and achievement of modern industrial and street lighting as we know it today."

* * *

JASPER BLACKBURN CORP., of St. Louis, manufacturer of electrical fittings, has announced plans to construct a new factory and office building in St. Louis County. The new brick and concrete building, on a ten acre tract at 1525 Woodson Rd., will house 90,000 square feet of factory space and 10,000 square feet of offices.

The large tract was purchased to allow room for expansion at a later date. The plant's docks will be served by spur lines from the Terminal Railroad and a 180 car off-street parking lot will be provided. Contracts have been let and construction started. R. N. Leach, executive vice-president of Blackburn, said that they expect to be in their new quarters by May, 1957.

* * *

HUBBARD AND COMPANY will begin construction in the near future on a new modern pole line hardware plant in Plano, Texas, 14 miles north of Dallas.

James H. Knowles, Hubbard president, said the new plant is being built to "keep pace with the increased demand for Hubbard's full line of pole line hardware in one of the most rapidly growing areas in the United States.

The plant is being built on a 14-acre site adjoining the Cotton Belt Railroad, and directly accessible to the new Dallas Express Highway. It is scheduled for completion this summer.

A steel structure, with aluminum siding, the new building will provide 30,000 square feet of floor space. In addition to production facilities for hardware manufacture, the plant will also have its own hot-dip galvanizing equipment and a warehouse area. Construction has been planned to permit further expansion.

"Your suggestion could be very profitable to us, Ferguson—provided we can persuade our competitors to adopt it!"

News about people

Southern States Equipment Corporation, Hampton, Georgia, recently announced the appointment of **E. W. Lindsay** as chief, Research and Development Section.

Mr. Lindsay, prior to coming to Southern States, was associated with Westinghouse Electric Corporation for a period of 13 years. During this time, he worked as a test, evaluation, and design engineer of electrical insulation and as a design engineer of switchgear and distribution apparatus. Mr. Lindsay has a degree in Electrical Engineering from Alabama Polytechnic Institute, Auburn, Alabama. Other educational accomplishments include graduate work in physics at Auburn and the University of Pittsburgh, and extensive undergraduate work in chemistry and mechanical engineering at Auburn.

E. W. Lindsay

James B. Hawkins has been named vice-president in charge of the Eastern division of **Virginia Electric & Power Co.,** Richmond, Va. Mr. Hawkins succeeds the late **Robert J. Throckmorton.** He was assistant vice-president for four years preceding Mr. Throckmorton's recent death.

G. A. Spencer has been named assistant treasurer to replace **A. L. Clark,** who has been named director of personnel.

Mr. Hawkins joined Virginia Public Service Co., a Vepco predecessor company, in 1926. Upon merger of that company with Vepco some 10 years ago, he became manager of the Blue Ridge district.

Mr. Spencer joined Vepco in 1936 and was director of the Auditing and Procedures department before his appointment as assistant treasurer.

Frank E. Stehlik has been appointed general manager of **General Electric's** Low Voltage Switchgear Department at Philadelphia. Mr. Stehlik succeeds **R. H. Jones,** who has been promoted to general manager, Air Conditioning Division.

Mr. Stehlik, originally from Oak Park, Ill., joined General Electric's business training program in 1934

Familiar symbols of safety

PROTECTION OF WIRING

The only wiring system approved by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies is a standard-threaded rigid conduit.

Wherever electrical wiring must function safely and efficiently in hazardous locations, install Youngstown Buckeye rigid steel conduit. It is easy to bend . . . easy to fish wires through . . . and economical, because its greater corrosion resistance means a longer, trouble-free service life. When you install Buckeye you're one of thousands of contractors, owners and architects who make it one of the world's best known brands of standard-threaded, full-weight rigid steel conduit.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

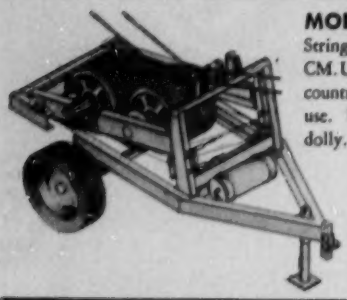
QUALITY YOUNGSTOWN SERVICE

Ask your distributor for Youngstown Buckeye Full Weight Rigid Steel Conduit and Youngstown Electrical Metallic Tubing.

Partial showing of the now ***COMPLETE*** line of . . .

PENGO TENSION WIRE STRINGING EQUIPMENT

Manufactured By PETERSEN ENGINEERING CO., Santa Clara, Calif.

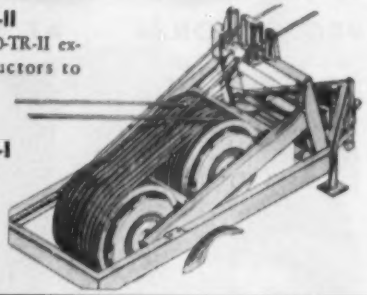


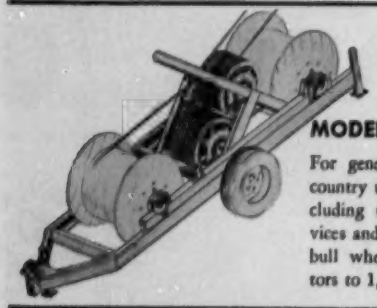
MODEL 5000-TR-II
Strings two conductors to 556,300 CM. Used primarily for very rough country work; also for general use. Use separate reel-carrying dolly.

MODEL 5000-TR-I
Similar except strings one conductor.

MODEL 6000-TR-II
Similar to Model 5000-TR-II except larger. Conductors to 1,272,000 CM.

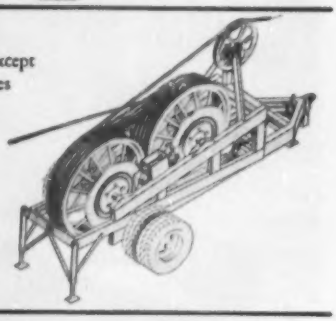
MODEL 6000-TR-I
Similar except for one conductor.

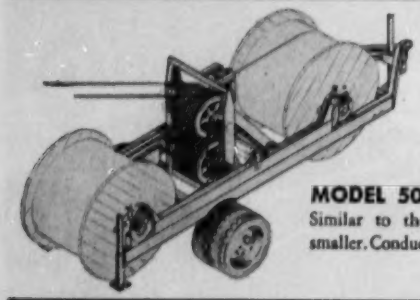




MODEL 6000-WS-TR
For general and medium rough country use. A complete unit including trailer, reel-carrying devices and its own double pair of bull wheels. Conductors to 1,272,000 CM.

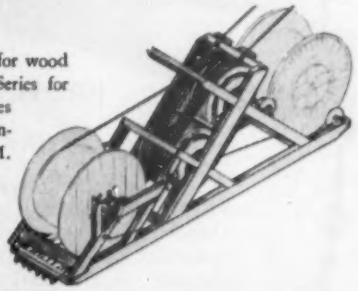
MODEL 7000-TR-I
Similar to model 6000-TR-I except larger. Conductors to 2 inches diameter.

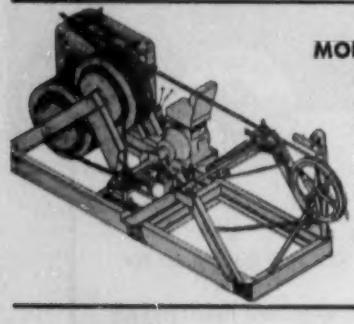




MODEL 5000-WS-TR
Similar to the 6000-WS-TR but smaller. Conductors to 556,300 CM.

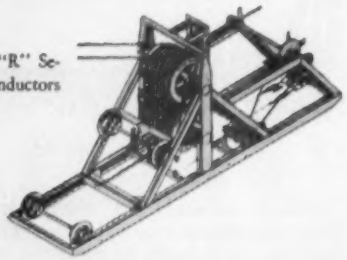
MODEL 6000-W
Available in "S" Series for wood or steel reels, in "R" Series for steel reels, or "SR" Series for trailer mounting. Conductors to 1,272,000 CM.

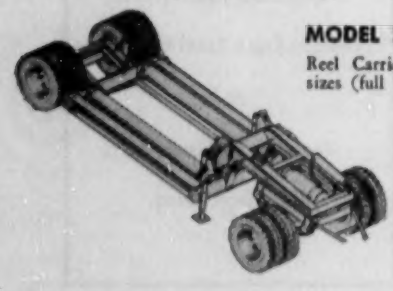




MODEL 6500
Bull Wheel Cable Puller. Available in "R" Series for steel reels, "S" Series for wood reels. Conductors to 1,272,000 CM. Also available in "LWR" Model for extra-large steel reels. Model 5500 similar (smaller).

MODEL 5000-SR
Available in "S" Series, "R" Series, or "SR" Series. Conductors to 556,300 CM.





MODEL 7500
Reel Carrier. Takes the largest sizes (full range) of steel reels. Loads and unloads with one man. No auxiliary equipment needed except the truck that pulls it. For use with any one of the tensioning machines shown on this page.

ADDITIONAL MODELS NOT SHOWN

Tension Reel Trailers

MODELS 2, 3, and 4, Two-Wheel Straddle Dollies not shown. For use with any one of the tensioning machines shown on these pages.

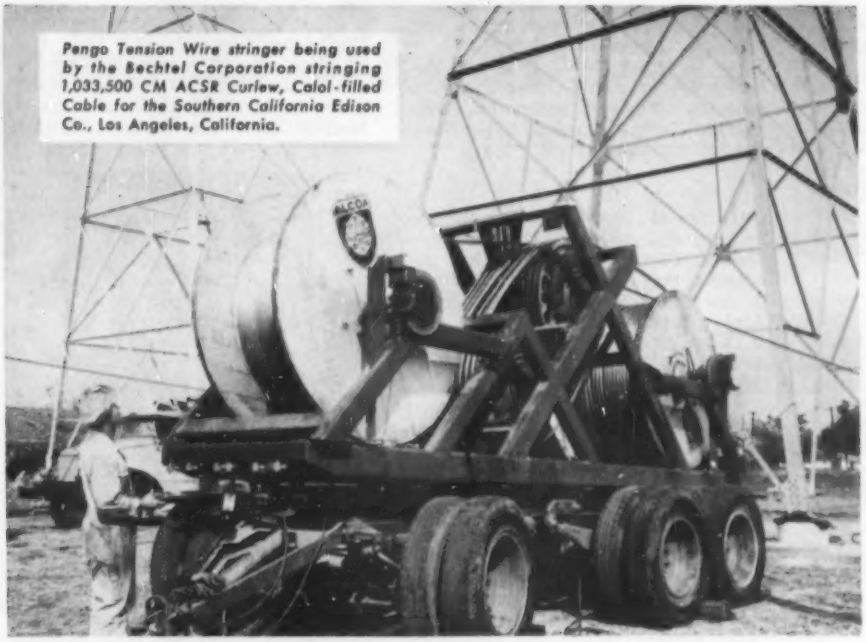
Tension Stringers

MODELS 6000-SK-I and 6000-SK-II For one or two conductors to 1,272,000 CM. Skid mounted for installation on owner's equipment.

MODELS 5000-SK-I and 5000-SK-II Skid mounted for installing on owner's equipment. For stringing one or two conductors to 556,300 CM.

MODEL 5000-WS-III Strings three conductors to 556,300 CM. For mounting on low-bed or full trailer.

MODEL 6000-WS-III Strings three conductors to 1,272,000 CM. For mounting on low-bed or full trailer.



Pengo Tension Wire stringer being used by the Bechtel Corporation stringing 1,033,500 CM ACSR Curlew, Calol-filled Cable for the Southern California Edison Co., Los Angeles, California.

The latest method of stringing conductors

- ***Safest, most economical for transmission, distribution and even secondary lines.***
- ***Its greatest savings are effected when stringing over and through energized circuits... by far the safest, too!***

Operation of the PENGO Tension Wire Stringer is almost unbelievably smooth. Because the tensioning is done on the Neoprene-Lined Bullwheels rather than on reels, conductor damage from the reels has been eliminated entirely. Due to the Neoprene lining of the Bullwheels, it is possible to use a full range of wire sizes to maximum groove capacity, which, in the case of the Model 6000-WS shown in picture, is Pheasant or 1⅝" diameter.

SMOOTH, POSITIVE CONTROL OF CONDUCTOR TENSION can be maintained at all times regardless of model or size of PENGO Tension Wire Stringer used. The large, specially designed PENGO disc brakes are mounted away from the Bullwheels to assure dissipation of the heat generated by the continuous braking action and prevent transmission of the heat to the Bullwheels.

In addition to the model shown in the picture, all series are available in low-slung trailer mounts for mountain work with separate easy-loading reel trailers.

List your requirements and send for descriptive literature and prices.

PETERSEN ENGINEERING CO.
Santa Clara, California Dept. 19

Please send me more information on the new Pengo Tension Wire Stringer.

Name_____

Firm_____

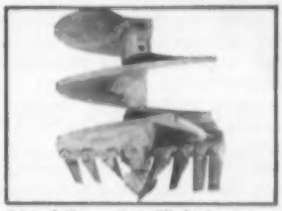
Address_____

City_____ State_____

Made by the makers of the World-Famous
PENGO EARTH AUGERS

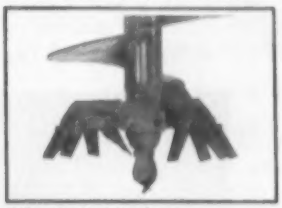
PETERSEN
ENGINEERING COMPANY
Santa Clara, Calif.

Other PENGO Products include:

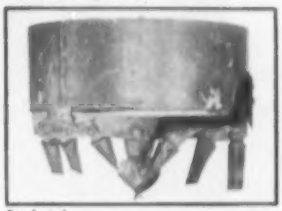


24 inch Heavy Duty Flight Auger

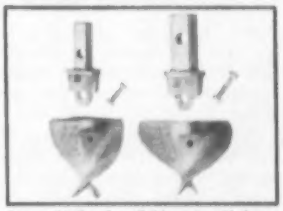
Double-Helix Heavy Duty Auger



Offset Boring Head

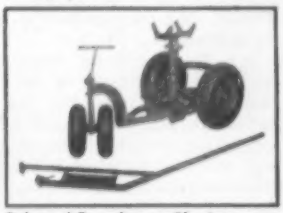


Bucket Auger



Screw Bit for Small Diameter Holes

Pulling Eye



Pole and Transformer Chariot

after he was graduated from the University of Wisconsin with a bachelor of arts degree.

After serving as a traveling auditor, accountant and later auditor of the Appliance and Merchandise Department at Bridgeport, Conn., he became manager of finance of the Small Appliance Division at Bridgeport, in 1951. He was named manager of personnel accounting services for the Accounting Services Division in 1954.

The appointment of **Howard Smith** as district sales manager for The **O. A. Sutton Corp., Inc.,** in the Atlanta, Chattanooga, Knoxville, Jacksonville, and Miami areas has been announced by Wes Brient, sales manager. He will be in charge of Vornado central system air conditioner sales and promotions in the area.

Mr. Smith is well known by both distributors and dealers throughout the southern section of the country.

Howard Smith

He has successfully directed sales and promotions of numerous national recognized products throughout the area.

For the past eleven years Mr. Smith has been district sales manager for appliance manufacturers. He also has several years retail sales experience gained through the operation of his own appliance business. He has been employed by both General Electric and Frigidaire to conduct special sales and service training schools.

The appointment of **Howard D. Kurt** as manager-product planning for the Distribution Assemblies Department of the **General Electric Company** has been announced by R. C. Wilson, the Department's manager-marketing.

Mr. Kurt will be responsible for the administration of all product planning activities for the Department. He will coordinate new product design and development activities, and will also serve as liaison on field problems involving application engineering and new product developments. He will also have responsibility for all published prices and product information.

Mr. Kurt was formerly an application engineer with General Electric's Industrial Power Application Engineering Unit, Apparatus Sales Division, Schenectady, N. Y.

George W. Weatherby, vice-president in charge of sales of **Portable Electric Tools, Inc.,** Chicago, has announced that they will be represented in the states of Tennessee, Georgia, Alabama, and Florida by **Reid H. Cox & Co.,** manufacturers representatives of Atlanta, Ga.

Appointment of **D. W. Rice** as product sales manager of the conduit division of **National Electric Products Corporation** has been announced by R. C. Bennett, Jr., vice-president of sales. He will direct the marketing of the firm's rigid and flexible steel conduit and electrical metallic tubing.

Mr. Rice has been in charge of surface raceway sales since joining National Electric Products Corporation in 1940. In that capacity he was instrumental in the development of the firm's surfaceduct, "plug-in" strips, low potential raceways and many electrical fittings used in today's modern residential and commercial wiring systems.

L. M. Grawemeyer, vice-president in charge of sales, Illuminating Division, **The Miller Co.,** Meriden, Conn., has announced the addition of **Jerry J. Poniske** as sales representative to the firm of Custer & Co., sales agency for The Miller Company in the St. Louis area, and the appointment of **Robert F. Helfrich** as sales representative for the Virginia territory.

Prior to his association with the Custer Agency, Mr. Poniske was sales

Jerry J. Poniske

representative for the Illinois Power Co. in the E. St. Louis area. He studied basic engineering at Notre Dame University and is a member of the Illuminating Engineering Society.

Prior to his becoming a manufacturers' representative in 1955, Mr. Helfrich was sales engineer and secretary at Virginia-Carolina Electric Sales in Norfolk, Va. He came to Norfolk from the General Electric

Robert F. Helfrich

Supply Co. in Raleigh, N. C. where he held the position of branch manager for 5 years. He holds a B. S. degree in electrical engineering from Virginia Military Institute at Lexington, Va.

The consolidation of three departments into one, and the appointment of **L. O. Bradshaw** to head the new department, was announced recently by **Baxter Wilson,** president, **Mississippi Power & Light Co.,** Jackson.

The new department will be known as "The Marketing & Development Department," and will encompass all of the functions performed by the three former development, advertising, and sales departments.

L. O. Bradshaw joined the company ten years ago at Cleveland, Miss., as an agricultural engineer. He transferred to the general office in 1948, and two years later was promoted to the managership of the agricultural and industrial section of the development and advertising department. When advertising and development were made into two departments in 1954, he became director of development for the company.

The department will function with **B. W. Davis** in charge of sales, and **Carl D. Mullican, Jr.,** heading the advertising.

The Fisher-Pierce Co., Inc., manufacturer of photoelectric lighting controls, recently announced appointment of **H. Walter Lent** of Alexandria, Va., and **Lyman Winn** of Memphis, Tenn., as new F-P sales representatives.

Mr. Lent will represent the company in Maryland, Virginia and the District of Columbia. Mr. Winn's territory will include the major portions of Tennessee, Kentucky, Alabama, Mississippi and Arkansas.

THIS IS BRAND NEW!

the ELECTRICAL SOUTH

DIRECTORY

of

ELECTRICAL MANUFACTURERS and their SOUTHERN and SOUTHWESTERN REPRESENTATIVES

1956 EDITION

PRICE $2.50

Now, for the first time, a special Directory for the use of the Southern and Southwestern electrical trade has been published by ELECTRICAL SOUTH.

In compiling this Directory, we have endeavored to furnish the most complete listing possible of all electrical manufacturers in alphabetical order together with their Southern and Southwestern representatives.

For convenience, a number of manufacturers have included cross - reference advertising on their products. This extra service will help locate special facts and specifications and other pertinent product data. So far as we know, this is the first Directory of its kind ever published for the Southern electrical trade.

Enthusiastic letters from Directory users confirm earlier survey reports stressing need for this type of information. The supply is limited . . . order your copy now.

Please send me the *new* ELECTRICAL SOUTH Directory; my check for $2.50 is enclosed.

Name _____

Company _____

Street & Number _____

City & Zone _____

State _____

G-E ELECTRIC RADIANT

a winter load that can improve annual

There are many utilities in the country which are considering electric house heating as one means of developing winter residential load to improve their annual load factor.

But what new problems does electric house heating present? Which types of electric heating should the utility promote? When and how should it be done? These and other questions must be answered before the utility can proceed.

In electric radiant heating, as developed by General Electric, many utilities are finding a practical, profitable and immediate answer to such questions. Here are some of the characteristics that make electric radiant heating a favorable type of load for them:

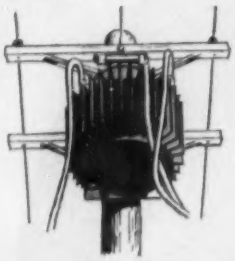
1 DIVERSIFIED DEMAND—Each room in each house has its own complete heating system, controlled by its individual room thermostat. The varying power requirements for each room, together with the varying requirements for each house make electric radiant heating a well-diversified load. Operating data so far available on electric radiant heating load characteristics show that peak demand does not exceed 70% of total connected load for an individual home, and for a group of homes, is considerably less than 70%.

2 NIGHT-TIME LOAD—The biggest part of the residential heating load occurs during the evening and early morning hours when industrial load is normally lighter.

3 BALANCES COOLING LOAD—For utilities that have a heavy summer air-conditioning load, electric radiant heating can be used to build winter load and improve annual load factor.

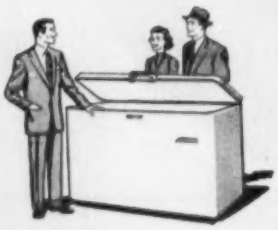
4 A RESISTANCE LOAD—Electric radiant heating is a unit power factor load, and from this viewpoint is a most desirable type load for the power company because it is free of power factor problems.

5 A PERMANENT LOAD—Once the electric heating load goes on the line, it is usually there for the life of the house.



6 WINTER EFFICIENCY—Because of lower ambients, system capability is more effectively used during the winter months when electric heating is required.

7 LARGE POTENTIAL MARKET—G-E electric radiant heating is practical for new homes, whether ceilings are plaster or dry-wall construction. In addition, supplemental or additional heat may be installed in either new or old homes by using G-E baseboard resistance heaters.



8 BETTER CUSTOMERS—Experience has shown that the residential customer in a house equipped with electric radiant heating becomes a better customer for the utility for all other electrical services. Consequently, electric radiant heating is another step in the direction of the all-electric home.

9 PEOPLE WANT IT—The enthusiasm home owners have for electric radiant heating not only opens up the whole residential heating market as a new source of revenue for the utility, but also — because it gives the utility a higher stake in providing services necessary for modern living — makes the utility a still more vital factor in the life of the communities it serves.

HEATING FOR HOMES

load factor for utilities which have summer peaks

G-E ELECTRIC RADIANT HEATING OFFERS MANY BENEFITS TO UTILITY CUSTOMERS

Practical — Ceilings provide a large unobstructed area for the radiating surface, efficiently radiating heat and warming objects and surfaces in the room. Through conduction, all these heated surfaces heat the air to a comfortable level. And, because G-E electric radiant heating is installed entirely within ceilings, building space that would otherwise be needed for heating equipment and fuel-storage can be devoted to living space. Also the expenses of a chimney can be eliminated entirely in homes that are equipped with G-E electric radiant heating.

Comfortable — Radiant heat from above is nature's way of heating. It provides complete comfort at lower room air temperatures. Practically eliminates drafts or air currents. Assures a comfortable humidity ratio because it doesn't "dry out" the moisture content of the air. All temperatures within the room are remarkably constant, with little variance between floor and ceiling.

Clean — With G-E electric radiant heat there is no dirt, soot, or dust from combustion or from circulating currents of air. Walls, ceilings, drapes, and furnishings stay clean and fresh much longer.

Convenient — The G-E electric radiant heating system has no rotating parts, operates without making any sound at all. No annual servicing plan is required, no refueling or checking of fuel supplies. Because there are no radiators or wall heaters, furniture and decorating can be arranged where and as desired.

Flexible — Individual room thermostats permit the temperature of each room to be controlled as desired. And because each room has its own thermostat, any changes in wind or sun that affect one or two rooms will be compensated for by the individual heating systems in those rooms. Here are all the advantages of zone control carried to the ultimate of room by room control.

Residential customers will like and want this new way of heating homes once they are acquainted with its many benefits. Consequently utilities which now have a summer peak are presented with a good opportunity to improve their load characteristics by promoting electric radiant heating.

For utilities interested in this electric heating load, the General Electric Company has prepared a portfolio of educational and sales helps. Included are technical data required for specifying and installing electric radiant heating systems, suggestions for utility sales programs, builder and consumer information, and samples of available promotion literature and display cards. Write Wiring Device Department, General Electric Company, Providence 7, Rhode Island.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SEND FOR UTILITY PORTFOLIO on G-E Electric Radiant Heating. Contains a complete file of educational and sales helps — technical data as well as promotion material — for utilities interested in this type of heating load.

Wiring Device Department
General Electric Co., Providence 7, R I.

Please send me a copy of the "Sales Portfolio on G-E Electric Radiant Heating".

Name.....

Company.....

Address.....

.....

The appointment of **Paul A. Crick** as sales representative in the North Texas area has been announced by L. M. Grawemeyer, vice-president in charge of sales, Illuminating Division, **The Miller Company,** Meriden, Conn.

Prior to his association with The Miller Company, Mr. Crick served as Southwest district manager for

Paul A. Crick

the General Electric Company. He is a graduate of Vanderbilt University with a B.S. degree in electrical engineering. After graduation from college he started his career with General Electric as a sales representative in South Texas and was transferred to Dallas in 1949. He has served as a sales representative for General Electric in Texas, Oklahoma and New Mexico and was appointed Southwest district manager in 1953.

Charles L. Holbert has been appointed executive vice-president of **H. K. Porter Company, Inc.,** according to an announcement by T. M. Evans, president. Mr. Holbert succeeds **C. R. Dobson,** who has retired.

Mr. Holbert came with Porter earlier this year as vice president. Before joining the company, he was executive vice-president of the Southern Pacific Milling Company, Ventura, Calif. Previously, he was vice-president and general manager of the Johnston Pump Co.

T. R. Banks has been appointed fan merchandising specialist for **Diehl Manufacturing Company,** Electrical Division of The Singer Manufacturing Company. His territory will include North and South Carolina, Georgia, Tennessee and Alabama, with headquarters in Atlanta, Ga.

In his new position, Mr. Banks will provide distributors with sales and product training. He will also assist them in their merchandising pro-

T. R. Banks

grams and various sales promotion projects for Diehl's line of fans and ventilators.

Prior to this appointment, Mr. Banks was associated with the Wheel Goods Division of Evans Products Company.

Paul H. Lobik has been appointed advertising manager of **Insulation Manufacturers Corporation,** Chicago, makers and distributors of electrical

CERTIFIED 45° x 45° SHIELDING FOR SCHOOL LIGHTING

HIGH IN EFFICIENCY 80.5%
HIGHER IN REFLECTANCE 0.93%
HIGHEST IN QUALITY
45296 - 430
Fluorescent by Southern
Here is a fixture not only pleasing to the eye with a 45° x 45° shielding angle, but it has all the qualities of SOUTHERN'S best in design and construction. Can be wired with regular, rapid start, and slimline ballasts. These 2 lite, 4 and 8 foot fixtures are constructed of heavy guage cold rolled steel, designed for either surface (ceiling) or suspension (stem) mounting. The modern designed louvers are securely attached to the "V" type reflector forming one unit, and may be lowered from either side without the use of tools. This SCHOOLITE fixture may be joined in continuous rows without additional parts.
Remember, specify and satisfy with SOUTHERN fluorescent fixtures.

SOUTHERN LIGHTING MFG. CO.
503 ELWELL ST. — ORLANDO, FLORIDA

12 - 55

insulating materials. Mr. Lobik was formerly advertising manager of Precision Scientific Company.

His background includes six years of writing and advertising at the Medill School of Journalism of Northwestern University (Chicago campus), and two years at the Illinois Institute of Technology. He also spent five years as a research technician at Elmdorf Research, Inc., investigating new and improved insulating and building materials.

Technical books

Electronic Engineering

By Samuel Seely, Published by McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y., 525 pages, $8.00.

This book provides a detailed discussion of a large variety of electronic circuits which are important in such diverse fields as radar, television, electronic control and instrumentation, and computers. Most of the radio field is excluded.

Beginning with a general introduction to tubes and tube circuit principles, the author then proceeds into a detailed consideration of the more important electron tube circuits. Emphasis is placed on the physical and mathematical analyses. With the help of this book, the reader will develop a solid understanding of the techniques of analysis, the special features of the many circuits examined, and the means for combining circuits of different types in order to achieve operational results.

Because one of the purposes of the book is to train the reader in techniques of analysis, occasional alternate methods of analysis are included of a given circuit, and varied analytical methods are employed in developing the material.

Thoroughly up to date, the book includes a chapter on solid state theory, and one of transistors as circuit elements, as well as most of the current electronic engineering problems. In all analyses, considerable care has been taken to include the requisite reference conditions for potential polarities, current directions, and transformer-winding sense.

With a Ph.D. from Columbia University, Dr. Seely has taught at the College of the City of New York, at the U. S. Naval Postgraduate School, and since 1947 at Syracuse University. From 1941-46 he conducted research on radar, electronics, and antenna theory at the Radiation Laboratory of the Massachusetts Institute of Technology.

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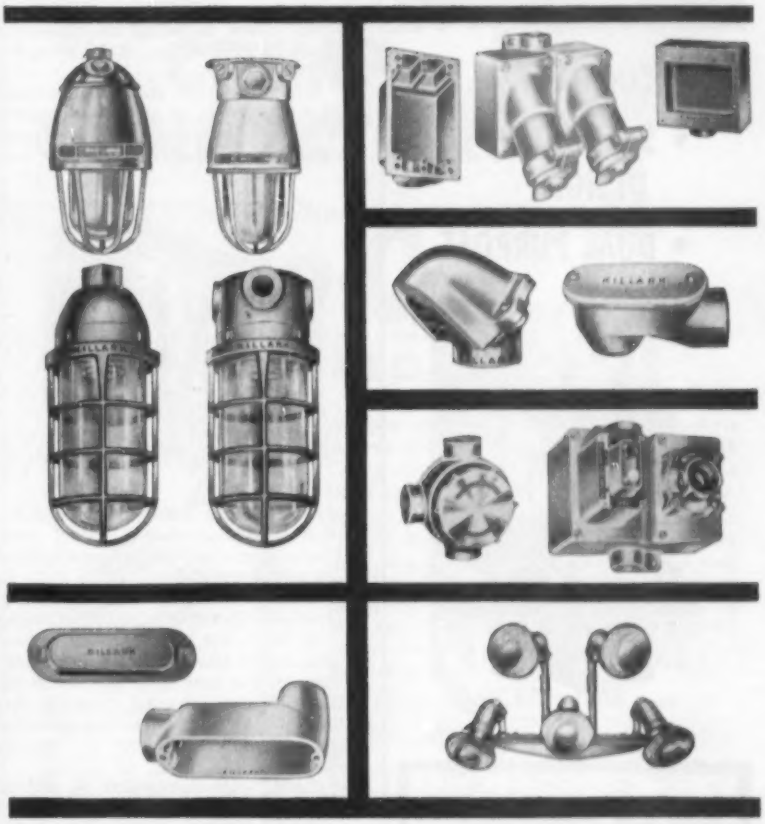

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FURNAS ELECTRIC
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- STANDARD DESIGN
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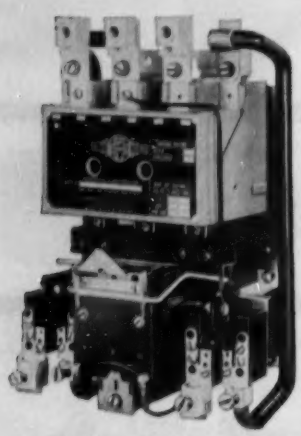

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COMPACT—The new size 4 is only slightly larger than size 3. STANDARDIZED DESIGN—Size 3 and 4 non-current carrying elements are interchangeable. This standardization has been made without compromising on life because larger contacts and other current carrying elements provide increased capacity. DUAL PURPOSE—Reconnectable dual voltage coils. Coil changing is eliminated and stocking of starters and coils simplified.

Write for Bulletin 5604, Furnas Electric Company, 1064 McKee Street, Batavia, Illinois

FURNAS ELECTRIC COMPANY
BATAVIA, ILLINOIS
Sales Representatives in all Principal Cities

New products

Curtis exit light line meets all local codes

A COMPLETE new line of UL listed recessed and surface-type exit lights, consisting of 198 varieties to meet all local codes, is being introduced by Curtis Lighting, Inc., 6135 West 65th St., Chicago 38, Ill.

Featuring one-piece body-frames of fused steel, all units are finished with a rust-proof, dirt-resisting, neutral tone aluminum bronze. Interior reflecting surfaces are finished with Curtis-developed baked white Fluracite enamel for maximum illumination of the sign.

Glass bottom panels in all surface-type units provide added illumination over the point of exit in accordance with many local codes. Another feature of the new line of Curtis exit lights is the upward opening door that eliminates all fumbling and groping during relamping or maintenance.

Curtis exit lights can be ordered through any authorized Curtis distributor. Units will be received as ordered in any one of the 198 different varieties, thus eliminating added handling and assembling on the job. An illustrated brochure, No. 4000, containing complete catalog information and specifications for Curtis exit lights, is available upon request.

G-E fluoroflood features all-weather illumination

A NEW FORM of fluorescent floodlighting designed to meet the specific requirements of many outdoor lighting applications has been announced by General Electric's Outdoor Lighting Department, Hendersonville, N. C.

Called the G-E fluoroflood, the new fixture combines many of the best features of fluorescent and floodlight units to produce a high level of evenly-distributed light over a wide area. The eight-foot rapid-start lamp generates 7250 initial lumens and offers all-weather illumination at a substantial savings in operating and maintenance costs, according to General Electric engineers.

An acrylic plastic cover is available for use with the unit and is recommended for installations in cold climates or during winter months. G-E lighting experts say the cover protects the lamp from drafts which materially reduce its light output at low temperatures. The fixture is designed to house the 96T12/CW/RS rapid-start fluorescent lamp which has been specially engineered for outdoor cold weather applications.

The sturdy fluoroflood has been engineered to withstand the effects of storm and wind damage but is light in weight — only seven pounds — and easy to install.

The unit is suitable for a number of outdoor applications, including service stations, parking lots, tunnel entrances, outdoor advertising poster panels, loading platforms, and other areas where a low cost, short range light source is desired.

Tork's 7-day time switch offers high selectivity

THE 7-Day Dial, introduced as a separate time switch by Tork Clock Co., Mt. Vernon, N. Y., early in 1955, has now been greatly improved and incorporated into Tork's standard line. Called the 7D1191, its slow moving dial is divided into 7 sections, marked for each day of the week.

Requiring a full week to make one complete revolution, the dial will accept screw-on trippers at even 2-hour periods in each of its daily segments, offering fine selectivity in 7-Day time switches. The use of these new screw-on trippers for On-Off action also permits manual operation of the time switch, if desired, without the need for relays as in former models.

The 7D1191 is recommended for use wherever daily schedules in lighting, heating, ventilating, air conditioning, refrigeration, or display signs may require variance. This

would include office and industrial buildings, retail stores, and institutions.

Nationally distributed through electrical wholesalers, the 7D1191 is also available in double-pole and other models. Tork Bulletin # 155, available upon request, lists all 7D and other standard light & power time switches, their uses, and housings.

Floodlight designed for "color improved" lamps

FIRST FLOODLIGHT designed specifically for "color-improved" mercury vapor lamps has been announced by Wilson Electrical Equipment Company, 2930 Commerce St., of Houston, Texas.

Called Wide-Lite, the new unit provides a broad, complementary pattern that can be overlapped smoothly to provide area coverage without

hot spots or valleys of shadow. Lateral light spread is 130 degrees and vertical spread is 40 degrees.

Wide-Lite installations require 47 per cent less power than those utilizing conventional incandescent lamps, and the units may be operated on 220 or 240 volts to cut installation wiring costs. Re-lamping maintenance is drastically reduced, because lamp life is six times that of incandescent floodlights, and fewer units are needed to properly light a given area.

Rectangular in shape to complement both the length and the diameter of the light source, Wide-Lite has a cast aluminum alloy enclosure. Trapping of light behind the lamp is prevented by a unique wedge-shaped reflector made of brilliant alzak aluminum. Airplane type fins are used for heat dissipation, and the unit has a pyrex glass lens. A baffle prevents leakage of light that has not been color-corrected, and the unit is completely sealed to insure long reflector life.

Wide-Lite offers an entirely new approach to many lighting problems. Industrial interiors and warehouse aisles may be illuminated to distances never before possible and

SIMPLEST, SAFEST

IDEAL

CRIMP CONNECTORS

with the "Wrap-Cap"*

THE UNIQUE DIAPER-WRAP INSULATOR

UL ONLY 2 PARTS

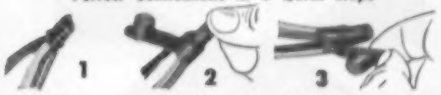
Both the cadmium plated steel sleeve and the "Wrap-Cap" insulator are listed by Underwriters Laboratories, Inc. for general use, (600 V) in branch circuit and fixture wiring.

*Patented, No. RE23649 and other patents pending.

Anyone who can use a pliers can make a perfect wire joint every time with the IDEAL Crimp Connector! The whole operation takes just seconds!

Stronger, better insulated and easier to use, IDEAL Crimp Connectors give you perfect, pre-fabricated insulation all around the joint and between the wires, with a puncture-proof cap and *double thickness* over the wire ends, *plus* a deep skirt that completely covers the bare conductor even when wires are not stripped evenly.

Perfect Connections in 3 Quick Steps



1 Crimp sleeve with IDEAL Electricians pliers.

2 Push "Wrap-Cap" down over sleeve.

3 Pull tabbed cap between wires and over end of joint.

NO EXTRA TOOL NEEDED!

(Patent Pending)

IDEAL All-Purpose ELECTRICIANS PLIERS

Crimp the Sleeve, Twist the Wire Burr the Conduit

A tool so good you'd want it even without the IDEAL Crimp Connector! Built for all around electrical use. Plastic covering on handles give comfortable grip.

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Easier to buy
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NOW you can tell at a glance, from a simple square footage figure, the right recessed lighting for any room. And, Pryne's new "Room Ratings" do all the work for you!

"Room Ratings" pre-calculate candlepower, cubic footage, room design and decor into the size and model Pry-Lite needed under actual on-the-job conditions!

Scientifically compiled by lighting engineers, with the finest of equipment, in Pryne's modern "Room Rated Laboratory"!

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City_____ Zone____ State_____

building exteriors can be lighted dramatically without dark areas to mar the overall effect. On outdoor advertising signs, one Wide-Lite will usually do the work of five conventional light sources.

Wide-Lite is being distributed nationally through electric wholesalers. For additional information about Wide-Lite models and accessories, write to Wilson Electrical Equipment Co.

Portable plaster groover solves dust problem

CALLED the "Wodack Electric Plaster Groover," a new, skillfully engineered unit is announced by Wodack Electric Tool Corp., 4627 W. Huron Street, Chicago 44, Ill., which permits the laying of electrical conduit and metal tubing quicker, easier, at considerable savings in labor costs and without filling the air with plaster dust or messing floors.

Marvelously efficient in its performance, the "Wodack Electric Plaster Groover" consists of: the case, which houses a Universal motor operating on a-c or d-c current; one 6" x ¼" x ½" special abrasive wheel with adequate guard, equipped with support handle and nozzle for attaching the hose of any commercial vacuum cleaner; and specially designed handle for easy and convenient grip, to which is attached a trigger switch and 15 feet of Neoprene cord with plug-in for any outlet. The entire unit is 18" in length and weighs only 16 pounds.

Special attention is called to the unique development which permits using any commercial vacuum cleaner for drawing away all plaster dust. This is not only a safeguard to the health of the operator, but solves the plaster dust problem when installations are being made in hospitals, homes or offices.

Portable bar racks designed for safety

PORTABLE heavy duty bar racks, manufactured by Palmer-Shile Company, 12675 Mansfield, Detroit, are especially designed for the safe, economical, and convenient handling and storing of piping and tubing. Design features act to prevent damage to stock of this nature in tiering and storing, the manufacturers point out.

The racks have a flush bottom and top. In addition to full wrap around crane bars, an extra thickness of lift bar is welded to the racks for additional strength and safety.

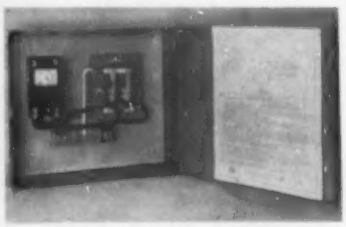
Piping and tubing may be stored safely in multiple tiers to any height, using automatic tongs suspended from an overhead crane. Racks are built to specifications to handle piping and tubing of any length and load capacity. The design also saves floor space while permitting storage of more stock tonnage. Stock selection and checking is made easy.

C. T. demand controls utilize current totalizing principle

SUNWARM, INC., Kingsport, Tenn., has been appointed U. S. representatives for "Load Miser" and "Rate Saver" demand controls, manufactured by C. T. Electrical Controls Ltd., of Canada.

Widely used throughout Canada and already approved by power authorities in various areas in the United States where demand rates are in effect, the C. T. demand controls are applied to existing house wiring to prevent over-consumption during peak periods, thus avoiding the higher demand rate bracket for power used. Both controls are competitively priced for the U. S. market, according to the announcement by F. T. Walsh, president of Sunwarm.

Utilizing the current totalizing principle, the "Load Miser" automatically disconnects less preferred loads (water heaters, dryers, etc.) when the preferred load, such as an electric range, exceeds a predetermined calibration point. When the preferred load consumption drops below this point, the less preferred load is automatically reconnected. The unit is available with either fixed or dial calibration.



Designed for electrically heated homes in demand rate areas, the "Rate Saver" control makes house heating more economical by reducing electrical demands, and also keeps the consumer within his existing 100 amp service entrance rating. This control utilizes the current totalizing principle to switch the heating load automatically on a reduced voltage

when the total household load reaches a predetermined value.

The "Rate Saver" results in considerable economy for the consumer with no appreciable loss of comfort, since peak periods are normally of short duration, and the accumulated heat plus the 25% heating capacity of the reduced voltage is enough to sustain comfort until the full load is again available for the heating circuit.

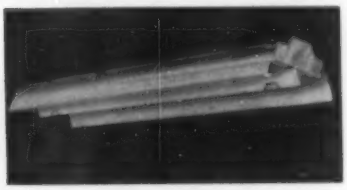
Both the "Rate Saver" and the "Load Miser" are compensated to allow for any changes in ambient temperature; and the "Rate Saver" may be used with or without an outside thermostat.

The current totalizing principle, used in both controls, integrates the current flowing in both live lines of the three-wire secondary distribution (or three-wire service entrance), and thus operates according to the total demand of the household and caters for any conditions of unbalance that may exist in the consumer's premises.

Industrial fixtures designed to meet RLM specifications

Two NEW heavy duty industrial fluorescent fixtures designed to meet the 1956 RLM specifications have been announced by The Miller Company, of Meriden, Conn.

The Imperial, IN-200 Series, (illustrated) provides approximately 25% upward light, 30° shielding crosswise, and is designed to meet the requirements of RLM specification SD-1 for semi-direct lighting. Ideally suited to modern manufac-



turning areas where high levels of glare-free illumination are necessary to the efficient production of precision products, this fixture is available in 2-lamp 48 and 96-inch sections for Rapid-Start, Slimline and 800 MA Rapid-Start lamps.

Featured are rugged one-piece 4-ft. porcelain enameled reflector sections with extruded apertures, heavy embossed ribs and rolled closed bead flanges for extra rigidity. Man-sized captive nuts provide easy reflector attachment and special reflector aligners assure uniform rows and seal light leakage between adjoining reflectors.

The Crown, IN-100 Series, provides approximately 10% upward light and is designed to meet the requirements of RLM specifications D-1, D-2 and D-3 for direct lighting. This fixture is ideally suited for general manufac-

Be happier... SELL QUALITY!

It's easy to do when you have Cavalier quality to sell at budget prices!

AUTOMATIC! Cavalier® ELECTRIC HEATERS FOR BATHROOM OR KITCHEN

- Lifetime stainless steel exterior, aluminum reflector and galvanized wall box. There's nothing to rust.
- Automatic control. Superior quality liquid-filled thermostat with enclosed contacts gives positive response to slight temperature changes.
- Space saving, flush-with-wall design. Cool-edge exterior grille permits safest use with plastic tiles.
- Bright, solid aluminum reflectors absorb no heat. Saves money—all the heat projected into room.
- Three beautiful models to choose from: CB-1.5A, automatic, 1500 W, 230/240V; CB-1.25C, automatic and CB-1.25B, non-automatic, 1250 W, 115/120V.

Quality sells quickly . . . budget-pricing makes it sell even quicker! Cavalier Electric Heaters are built to create sales and satisfied customers. They've got lasting features that mean happier, easier-to-get business for you. What's more, Cavalier quality eliminates profit-robbing call-backs. With Cavalier, you make and keep a businesslike profit!

Sell constant warmth without waste. Cavalier heaters never let rooms get cold, never waste current by overheating. The finest heat available costs so little . . . gives so much extra convenience. **Show and sell Cavalier for happier business.**

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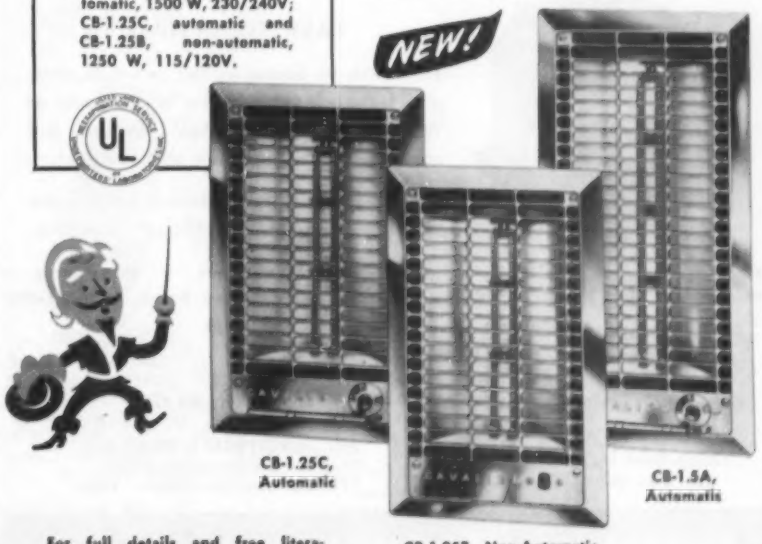


CB-1.25C, Automatic

CB-1.5A, Automatic

CB-1.25B, Non-Automatic

For full details and free literature, see your distributor or write.

Electric Heating Div., CAVALIER CORPORATION, Chattanooga 2, Tenn.

CAVALIER . . . A RESPECTED NAME SINCE 1865

turing areas where an upward component of 8 - 15% is required.

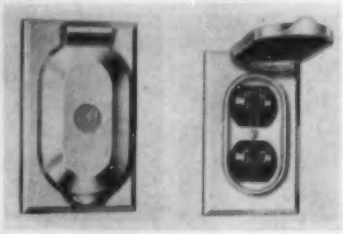
Available in 2 and 3-lamp 48 and 96-inch Rapid Start and Slimline, 2-lamp 48 and 96-inch 800 MA Rapid-Start, and 2-lamp 60-inch T-17 General Line, it features rugged one-piece 4-ft reflector sections with extruded apertures and embossed shoulder ribs for extra rigidity. Large size knurled nuts provide easy reflector attachment without the use of tools. A special clamping-type reflector aligner assures uniform row alignment and seals adjoining reflectors against light leakage.

Flush duplex receptacle for outside installations

THE AVAILABILITY of a new line of flush duplex weatherproof receptacles is announced by The Arrow-Hart & Hegeman Electric Company, Hartford, Conn.

This latest addition to the line of Arrow-Hart wiring devices will readily accommodate any two standard plug caps, unlike the ordinary weatherproof outlet. This unique weatherproof assembly is available with a wide range of duplex receptacles—up to twenty different types. These include the standard duplex type, the conventional grounding duplex type, the new grounding type combination duplex which provides two separate circuits (125 and 250 volt) with a common ground, and the Hart-Lock type which prevents accidental disconnects.

Suitable for use wherever installation exposes receptacles to the



weather, moisture, acid fumes, etc., this new weatherproof receptacle features cast aluminum plate, a spring lift-lid cover with a rubber gasket that seals the cover when closed, and a rubber mat on the underside of the plate that makes a weatherproof seal between the box opening and the building wall.

Plastic-coated ignitrons protect against high voltage

PLASTIC-COATED ignitrons which provide protection against hazardous voltages and reduce moisture-condensation on the exterior of the tubes are now available exclusively from General Electric.

The plastic coating is applied on the G-E Tube Department's "convertible" types GL-5551-A, GL-5552-A, and GL-5553-B (sizes B, C, and D, respectively), which are used extensively in welding and other power conversion applications.

The plastic-coating process consists of applying a thickness of about .050 inch of polyvinyl chloride on each tube. This coating is designed to provide protection for maintenance personnel from dangerous high voltages which exists between the outer jacket of the tubes when they are connected in a typical inverse parallel welder circuit.

To emphasize the hazard involved in this type of circuit, all General Electric plastic-coated ignitrons are red in color with the words "danger-voltage" stamped conspicuously on each tube.

Portable washer cleans vinyl light diffusers

A WASHER to clean and destaticize light diffusers of rolled corrugated vinyl, .007 wakon, sylvan aire, etc., has been announced by the Piolite Division of Pioneer Plastics Corp., Peabody, Mass.

The washer is a two-man, portable on 4" casters, 63" x 71" x 45" high,

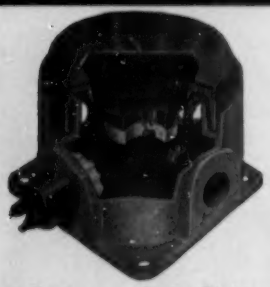
and weighs about 500 lbs. It is non ferrous except for angle iron frame, contains three tanks for washing, rinsing and destaticizing, and washes at the rate of eight lineal feet per minute with two ¼ hp. a-c motors. A six page folder is available on request.

Automatic portable fan with thermostat control

THE NEWEST Kord fan features comfort and convenience in a completely automatic portable fan that's lightweight and ideal in any room in the house . . . makes a wonderful "traveler."

The modern thermostat control assures complete comfort wherever you go . . . automatically starts and stops to keep room at desired tem-

Latrobe PRODUCTS
FLOOR BOXES • WIRING SPECIALTIES



EASY TO INSTALL

There are no excess screws, wires or complicated parts in "Latrobe" Floor Boxes or Wiring Specialties. Their design and mechanism is simple, sure and compact.

That is why "Latrobe" Products are so quick and easy to install—so efficient in service.

Floor Boxes • Cover Plates • Pipe or Conduit Hangers • Gang Boxes • Nozzles • Fish Wire • Cable Supports • Junction Boxes • Insulator Supports • Staples and Cable Clips

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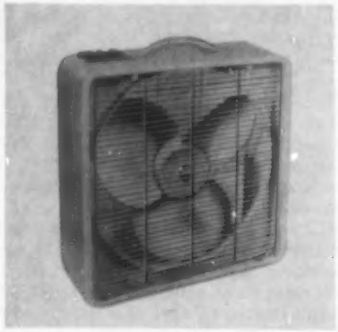
perature. Kord's push button portable is electrically reversible. . . simply press a button to reverse air flow . . . changes from exhaust to intake in a moment. Six convenient speeds are



featured—three intake and three exhaust for truly modern comfort control.

Kord's famous Safe-Tee-Gard grill assures complete protection . . . eliminates possibility of needless accidents. The 20 inch aluminum propellers with rubber hubs have been proven quieter by actual test.

New slotted angle system solves storage problems

A NEW WAY to save time, money and space in solving storage and construction problems is now offered by the FlexAngle Corporation, formerly Flowstrut Corporation, West Hartford, Conn.

This new system, called the FlexAngle Universal Slotted Angle System, makes the most of space, money and materials for storage racks, shelving, bar stock racks, pallet racks,

maintenance platforms, building framework, machine bases, electrical mountings, etc.

It has almost universal application because the FlexAngle units require no drilling, no welding, are premeasured, pre-painted, save up to 98% storage space, and are completely re-usable.

FlexAngle angles of 11 (.1196 USS) and 14 (.0747) gauge steel are preslotted with cutting marks at 3" intervals. Measuring is all done—just count, cut and bolt.

Slater SPECIFICATION GRADE

GROUNDING RECEPTACLES

Send for your FREE illustrated price sheet . . . lists all Slater Wiring Devices

S-321-BR

Single receptacle, brown, Nema 125 Volts—15 Amperes, with ears. Available in ivory (S-321-IV) or with no ears (S-320).
List price 80

S-328-BR

Nema, 15 Amperes — 250 volts, with ears. Sturdy bakelite. Compact design. Available in ivory (S-328-IV) or with no ears (S-327).
List price 80

S-396-BR

20 Amperes—250 volts, 3-wire, 3-phase or single phase with grounding, with ears. Available in ivory (S-396-IV).
List price $1.45

SPECIFICATION GRADE

320-BR

Duplex receptacle, brown, Nema, 15 Ampere, 125 Volts, with ears.
List Price . . .
320-BR $2.19
320-IV $2.31

2-CIRCUIT

322-BR

New, 2 circuit duplex receptacle—15 amperes, 120 volts; 15 amperes, 250 volts. Furnished with ears and in ivory (322-IV).

326-BR

Combination 2 and 3-wire duplex grounding receptacle with ears. Also accepts parallel bladed caps that do not require grounding. 15 Ampere, 125 Volts, 10 Ampere, 250 Volts.
List Price . . .
326-BR $2.24
326-IV $2.39

393-IV

New, 2 circuit duplex receptacle, 15 amperes, 125 volts. 2 wire at one end; 10 amperes, 250 volts, 3 wire at other end. U/L approved. List price—
$2.00 BR, $2.10 IV

394-BR

New duplex receptacle takes either tandem or 3-wire crow foot caps, 2 circuits, 20 A-250 Volts, and 15 A-250V.
List Price . . . includes steel wall plate . . .
394-BR $2.44
394-IV $2.54

3200-BR

Intermediate grade, Nema duplex receptacle 15 amperes, 125 volts.
List Price 90

Covers available
Add suffix-3 for receptacles on 3¼" cover
Add suffix-4 for receptacles on 4" cover

Send for Bulletin 37.

Slater ELECTRIC & MANUFACTURING COMPANY
56TH STREET AND 37TH AVENUE • WOODSIDE 77, L. I., N. Y. • ILlinois 8-6500

Slater switch provides noiseless operation

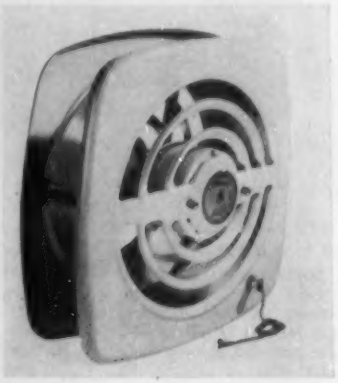
A NEW, MECHANICAL switch provides noiseless operation for incandescent and fluorescent lights. Made by the Slater Electric & Manufacturing Company, of Woodside, Long Island, New York, this line of quiet switches is rated 15 amperes-120 volts a-c only; 15 amperes-277 volts a-c only; and 20 amperes-120 volts a-c only; 20 amperes 277 volts a-c only.

Offering quiet operation, they can be mounted in any position. Available with speed wire (rear wiring) with patented side release or with screw terminals. Choice of three-wire system or built-in shunt—single pole, double pole, 3-way and 4-way. Known as the Slater 600 Series of quiet switches, construction features include special silver alloy contacts, extra-heavy plated steel strap, plaster ears, and sturdy Bakelite case—takes No. 12 or No. 14 wire.

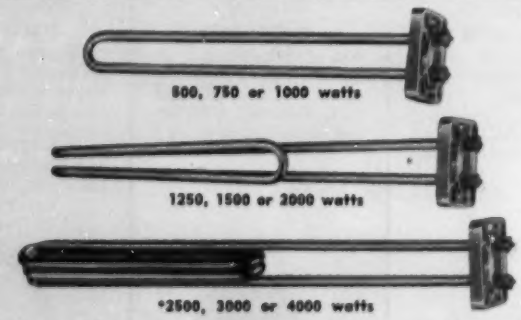
Room-to-room fan offered by Broan

A THROUGH-THE-WALL fan that propels warm or cool air from one room to another is now available from Broan Mfg. Co., 1669 N. Water St., Milwaukee 2, Wisc. It is called the No. 700 room-to-room fan and, according to the manufacturer, it equalizes room temperatures and provides greater economy in the operation of room air conditioners, space heaters, wall type heaters or floor furnaces.

This eight-inch diameter, venturi-type fan delivers air silently at the



rate of 250 cubic feet per minute. It is manually operated by a pull chain switch, and adjustable for walls 2½ to 5¼ inches thick. Design is modern and the finish is white baked enamel. Installation is easy and inexpensive.



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Free bulletins

Publication of the 1956 Edition of the RLM Standard **Specifications for Industrial Lighting Units** has just been announced by the **RLM Standards Institute,** 326 W. Madison St., Chicago 6, Ill. The new edition contains important revisions in specifications on both incandescent and fluorescent industrial lighting units, as well as new lighting data of special value to specifiers.

Copies of the new book are available to architects, electrical contractors, lighting specialists, utility lighting men, purchasing agents, industrial executives, and others concerned with the buying, selling or specifying of industrial lighting units.

Most important of the changes and additions in this 1956 RLM Specifications Book are the new coefficient of utilization tables for eight different incandescent and fluorescent lighting units. Calculations are based on the latest Zonal Method of computing coefficients of utilization and illumination on room surfaces.

A general discussion of **protective relay maintenance** and testing with particular attention to the equipment and records that are necessary for assuring safely operative relays and breakers has been published by **Multi-Amp Corporation,** 10 Third St., Newark, N. J.

Tables and hook-up schematics show how one typical high-current test instrument is used for achieving test results under conditions that closely simulate actual overload values.

A complete 48-page data book on Keystone **heat-resistant cables** has just been released by the Hazard Division of **The Okonite Company,** Passaic, N. J. Typical test results are given for Keystone butyl rubber insulation under conditions of high heat and extreme moisture.

Also included are dimensional tables for power and control cables for direct burial and duct use as well as 24 pages of valuable engineering information helpful in selecting and applying the proper cable to the specific job.

A 36-page, 8½ x 11, two-color illustrated catalog (Bulletin B-1013) describing Series 203 **axial fans for ventilation,** process air supply and process air recirculation applications is now available from **American Blower Corporation,** Detroit 32, Mich.

The catalog describes and illustrates tubeaxial and vaneaxial flow

principals and explains the various arrangements possible with American Blower axial fans. It contains eight pages of selection tables and three pages of installation type drawings giving detailed dimensions for the full range of direct drive tubeaxial, direct drive vaneaxial and V-belt drive vaneaxial fan sizes. A special guide for the use of architects, engineers, and fan buyers when ordering axial fans is also included.

Publication of a new brochure for **heating contractors and engineers** was announced recently by the **International Register Co.,** of Chicago, manufacturer of Intermatic time switches. The four-page folder describes the use of automatic time controls with oil burners, gas units, and stokers.

Standard timer applications are listed together with the type of time control required for each. A brief description of the switch action upon the temperature control is given for each application.

A section devoted to wiring diagrams accompanies the suggested uses, which should be of special interest to contractors. Control of various types of thermostats singly and in combination is illustrated.

Copies of Bulletin NR-26 are available from the company, 2620 W. Washington Blvd., Chicago 12, Ill.

Litecraft Manufacturing Corp., 8 E. 36th St., N. Y., N. Y., has issued List Price Schedule L-1 covering its complete line of **incandescent lighting fixtures.**

The price schedule is expressly designed for use with the Litecraft illustrated catalog which contains some 400 Litecraft designs. Using the catalog and schedule together, it is now easy to find prices, standard quantities, shipping weights and other information in one convenient source.

A three-way cross reference index on the cover of the new schedule makes it especially simple to find any fixture in a jiffy. Using the index, information can be found under catalog section heading, group name, or catalog number.

How to **dig holes easily and rapidly** is the subject of a new catalog on the Holan 4401-H portable hydraulic earth borer.

The four-page catalog has line sketches, close-up views of construction, and action photos of the new Holan digger. The unit bores holes eight to 20 inches in diameter and up to eight feet deep. A variety of cutter heads is available.

For copies of the catalog, write to **J. H. Holan Corp.,** 4105 West 150th St., Cleveland 11, Ohio.

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The series of handy pocket-sized booklets, **How to Use Hand Hack Saws, How to Use Power Hack Saws** and **How to Use Band Saws,** has recently been revised and reprinted by **The Capewell Manufacturing Co.,** Hartford, Conn., manufacturers of hand and power hack saws, band saws, ground flat tool steel, hammers and pipe fitters' hand tools. The booklets are being offered free of charge to Capewell customers and other trade sources.

Copies of these booklets may be obtained from any Capewell distributor or by writing direct to the company. 60 Governor St., Hartford, Conn.

A bulletin on **General Electric's** new 15,000-volt **outdoor current transformer**—the first to be molded of Hy-Bute/60 insulation—has been announced by the company's Instrument Department.

The two-color, eight-page publication highlights the advantages derived from the use of Hy-Bute/60 insulation, including smaller size, lighter weight, increased mounting versatility, greater strength, reduced maintenance, safer operation, and longer life.

Information on application, construction, accuracy, mechanical and thermal ratings, and ratio and phase-angle test data is also incorporated in the publication.

Designated GED-2727, the bulletin is available from the General Electric Company, Schenectady 5, N. Y.

A new booklet entitled **Electric Heating Users Guide** is available from the **Westinghouse Electric Corp.** The 20-page booklet is a comprehensive discussion of home heating in general and electric heating in particular. Included are such topics as the need for heat, the different methods of electric heating and the costs involved with such heating. It is written for architects, consulting engineers, and electric utility and contracting personnel.

For a copy of this booklet B-6709, write to the company, P. O. Box 2099, Pittsburgh 30, Pa.

Allis-Chalmers standardized and package **substations for light load areas** are described in a new bulletin released by the company.

The bulletin lists the material furnished for high and low voltage structures and diagrams optional arrangements for each.

Common ratings are 1000 to 3000 kva with high voltages of 23, 34.5, 46 or 69 kv, and low voltages of 7200/12470Y or 7620/13200Y. However, capacities and voltages available are not necessarily restricted to these and nearly any requirements can be met.

Copies of the bulletin, "Substations for Light Load Areas," are available on request from the company, 938 S. 70th Street, Milwaukee, Wisc.

Mathias Klein & Sons, Chicago, manufacturer of tools and equipment for linemen and electricians, has prepared a **"Grip Selector"** which immediately shows the proper Klein grip to use on all the popular sizes and types of wire—aluminum, steel and copper, solid and strand, weatherproof and bare. The selector not only shows the grip number recommended for each type of wire but the weight of that particular grip and the safe load it will carry. Copies of the "Klein Grip Selector" may be had by writing to Mathias Klein & Sons, 7200 McCormick Road, Skokie, P. O. Chicago 45, Ill.

A 36-page catalog, illustrated in color, entitled **Fluorescent Lighting Fixtures,** is available from **Great Northern Manufacturing Corp.,** 1056-8 N. Wood St., Chicago 22, Ill. The catalog contains information, illustrations, specifications, and applications on the complete line of Great Northern fluorescent lighting fixtures and mercury vapor lighting.

Four new data sheets, two of which describe the use of Wiremold in **wiring for room air conditioners,** are available from the **Wiremold Company,** Hartford 10, Conn.

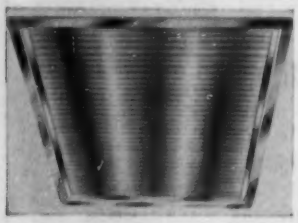
Data sheets A9 and A10 deal with the problem of providing adequate feeders and branch circuits for room air conditioning units.

The installation of Plugmold 2000 to provide electrical outlets in a project of 96 garden type apartments is described in data sheet C7.

Data sheet F19 tells about the wiring for present and future needs in a new office building which was constructed with floors and outside walls only, and in which partitions were added as required.

A factory-assembled **plug-in busway system** permitting direct connection to bus bars for feeding lighting and power loads in industrial plants, schools, offices, commercial, and public buildings is described in a new 20-page, two-color bulletin issued by the Distribution Assemblies Department of the **General Electric Company.**

The new publication describes in detail the construction and application of this G-E plug-in busway sys-



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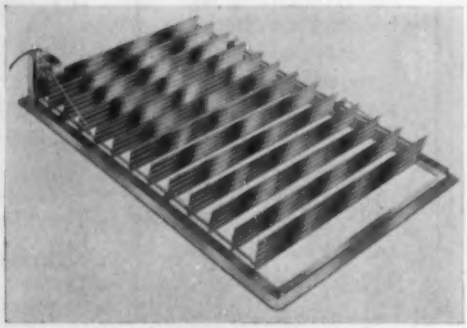

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tem. It also lists ratings, weights, dimensions, installation data, and guide form specifications.

The busway, known as Type FVK incorporates either aluminum or copper bus bars and is designed for 225- to 1000-ampere, 600-volt secondary feeder systems. It is used for two- and three-pole, 600-volt, three-phase, four-wire, 120/208Y-volt, and 480Y/277-volt applications.

Copies of the new bulletin (GEA-6470) may be obtained from Advertising & Sales Promotion, Distribution Assemblies Department, General Electric Co., Plainville, Conn.

Complete information about **General Electric's** new Type HR **automatic recloser** with hydraulic timing mechanism is offered in a bulletin designated GEC-1374A. Entirely compatible with other hydraulic reclosers, the G-E unit is now available for 14.4 kv at 50 amperes. Other ratings to be in production this year are 14.4 kv at 200 amperes; 23 kv at 100 amperes; and 14.4 kv at 280 amperes.

The bulletin includes product features, application information, ratings, dimensions, and pricing information. Requests for the publication should be addressed to the General Electric Co., Schenectady 5, N. Y.

Relay conference

(Continued from page 54)

the source breaker to operate two times. If these two reclosures are unsuccessful, the probability of a permanent fault existing is very good, and the air break switches operate while the station is dead between the second and third reclosures of the source breaker and thus isolate the faulted section.

Microwave channels

Two papers were presented at the concluding session on the use of microwave channels for system protection. G. D. Rockefeller, of Westinghouse Electric Corp., discussed "Pilot Protection Utilizing Wire or Microwave Channels," while C. L. Headley, of Baltimore Gas and Electric Co., described his company's operating experience with microwave channels for relaying on the Baltimore system.

The conference was concluded with a symposium on relay troubles and steps toward correcting them, over which E. B. Henry, of Gulf Power Company, presided. Participating in the discussion were C. M. Gadsden, of Duke Power Co.; J. M. Pinkerton, of Nashville Electric Service; and Jerry Vandermere, of Alabama Power Co.

The symposium reported numerous difficulties arising in the protective relaying schemes for power systems which could be traced directly to the fault or failure of the relaying components used.

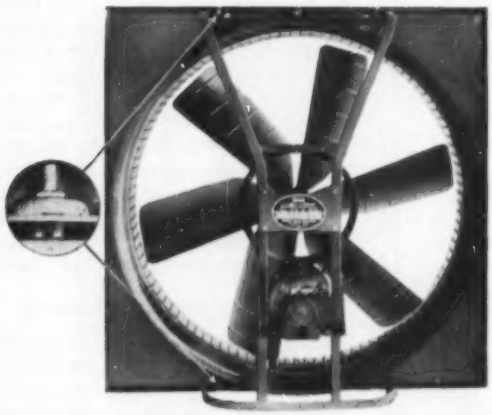
The speakers pointed out that some of these troubles are a result of the fundamental design, while others follow from production, testing, and inspection methods.

Capacitor switching

(Continued from page 49)

switched capacitor bank has its "on" setting selected to lag the "on" operation and to precede the "off" operation of most circuit switched capacitor banks supplied by that substation. Substation banks were primarily used during the heavy summer time load periods.

(3) Some substation switched capacitor banks, which had been voltage controlled, were changed to operate on voltage compensated



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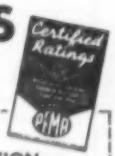

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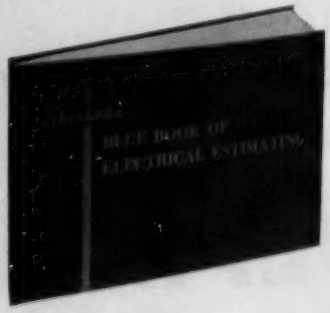
by time clock. This modification consisted of using the time clock to connect a voltage dropping resistor in the voltage control circuit, thus when the time clock "turn-on" contact was opened, the voltage control saw a low enough voltage to operate the capacitor bank.

Similarly, when the "turn-off" contact was engaged the resistor was bypassed, letting the voltage control see actual bus voltage. The bus voltage, of course, would normally be high enough to turn the capacitor off. Normal bus voltages at the substations in which this type of switched capacitor bank was located did not vary enough to cause consistent daily operation of the control mechanism.

Figure 5 is a graphic record showing this type of capacitor operation under normal conditions. The control settings were determined from an ammeter and voltmeter record taken on the substation bus. These recordings were taken at the time of year the capacitor banks would normally be used. Using the off-peak or early morning load value as a base value, a 60% increase above this value was chosen to indicate the time the reactive load on this station would be sufficient for switching on the substation capacitor bank.

Figure 2 is a graphic record of the substation bus voltage showing the times when the substation capacitor was switched. A 60% load increase value was reached at 8:00 a.m. "turn-on" time. The bus voltage at this time was 124 volts. The "turn-on" contact opening allowed the resistor, having a 3-volt drop, in the contact making voltmeter (CMV) cicruit to drop the CMV voltage from 124 volts to 121 volts. The CMV "turn-on" contact closed at 122 volts, causing the capacitor bank to be energized. The bus voltage increased 3½ volts from 124 volts to 127 volts, due to the capacitor bank being energized. Also, the CMV voltage increased from 121 volts to 124.5 volts.

The clock was set to close "turn-off" contact at 10.30 p.m. The clock's operation removed the 3-volt drop from the CMV and the CMV voltage increased from 124.7 to 128.2 volts. This voltage was greater than the 126.5 volts, normal CMV "turn-off" voltage level, therefore, the CMV causes the capacitor bank to be de-energized.



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July, 1956

Performance of capacitor banks

Nineteen graphic reactive meters had been installed on certain substations to show the reactive load existing. From this record, the use of capacitors to supply the reactive load was checked.

Figure 3 shows the reactive load for a typical one-day period* on a 2,500 kva substation. This substation is new and located in a rapidly growing residential area and it has the one 4-kv feeder circuit. There are two 300 kvar time clock switched capacitor banks located on its circuit. Note the capacitor operations, one "turn-on" at 6:30 a.m. and one at 7:30 a.m. "Turn-off" occurs at 9:00 p.m. for one bank and 10:00 p.m. for the other bank.

Figure 4 shows reactive load for a typical one-day period on an 18,000 kva substation. There are eight 4-kv feeder circuits supplying the predominately residential area load. Fifteen time clock switched capacitor banks are operating "turn-on" from 6:45 a.m. to 8:00 a.m. and "turn-off from 9:00 p.m. to 11:00 p.m.

Figure 5 shows reactive load for a typical one-day period on a 12,-750 kva substation. There are four 300 kvar time clock switched capacitor banks located on 4-kv feeder circuits and two 1,260 kvar time clock switched capacitor banks located on the substation 4-kv bus. The circuit banks are switched on commencing 7:00 a.m. to 7:30 a.m. and switched off at 9:00 p.m. to 9:30 p.m. The substation banks are operated on at 7:05 a.m. and 7:35 a.m. and operated off at 9:25 p.m. and 10:40 p.m. The two substation banks have voltage control compensated by time clock.

Operation and maintenance

Normal adjustments and checking of time clock controlled switched capacitor banks are made once a year. The time for checking distribution circuit bank operation was in May and early weeks of June. Substation units are generally checked the latter two weeks of June.

The time of operation for clock control mechanisms was established by a central office. Under the cognizance of this office, the use of switched capacitors to meet

*Editor's Note: Reactive loads were measured with 7-day recording meters but space here permits showing only a typical day's operations.

the reactive load requirements was coordinated. System as well as substation reactive loads, where metered, are under constant observation.

Conclusion

The data presented in this paper shows that switched capacitor banks can be successfully used to supply the changing reactive load on an electric utility system.

Study of the reactive load variation by a central office is needed to establish a time schedule and to coordinate the switching of capacitor banks to meet the system needs.

Metering the reactive loads at substations and at selected points on the system provides data for engineering capacitor installations and the settings for switch controls.

Thermostatic switches

(Continued from page 47)

to the other 240-volt line wire.

One of these leads was carried through a current transformer connected to a recording ammeter. In this manner, we got a recording of current flow through the thermostats. It was simple, due to the difference in current drawn by the 3 and 5 kvar units, to tell which one, if either, was on the line since this meter would indicate a fixed amount for each capacitor with the sum of currents being shown for both, and of course, none being shown when neither was on. By counting the operations shown on the chart, we could of course, arrive at the total number of operations for each switch.

In addition, we installed a 2-pen recording thermometer, with one bulb at the thermostat location, and the other to read ambient temperature. Due to the low temperature, 55°F, necessary to cause one of the switches to operate, this equipment was set up outdoors. With this method of testing, we set the equipment in operation.

When the test was stopped we found, upon checking the ammeter charts, that we had a total of 1314 operations on the thermostat switching the 3 kvar capacitor, and 1276 operations on the 5 kvar switch. These give us a total of approximately 17 years of normal operations.

At this time, the thermostats were disassembled and the contacts were inspected to see how much, if any, useful life was left in the switches. Much to our surprise, we found that even though these thermostats had switched considerable amounts of capacitive current for a relatively large number of operations, (12.5 amps for the 3 kvar, and 20.8 amps for the 5 kvar unit), the contacts, although slightly burned, showed that they could have probably operated several times as long as we had them on test, before failure.

As a result of these tests, we adopted these thermostats for control of our secondary capacitor switching applications.

Know the law

(Continued from page 40)

ing a lien claim dates from the time when the debt owing the claimant becomes due: Alabama, Texas, Missouri. But the courts of different states do not agree as to

when the debt is to be considered as having become due.

In some states it is just as important, to the validity of a lien, that notice of the lien claim be not filed too soon, as it is not to file too late. In these states, appelate courts have decided that liens were not enforceable because prematurely filed: Alabama, Virginia, and Kansas.

Labor relations

(Continued from page 38)

One day Dobson's name went on the list and Burnette's name was left off. Burnette had a chance to see the list which was posted on the bulletin board, but he didn't put in any complaint. The following week, however, he claimed pay for four hours at time and a half because his name had been skipped on the listing.

The foreman checked and found that indeed an error had been made. Dobson had four more hours of overtime than Burnette and should not have worked that week's overtime. To make it up to Burnette, he was told he would get the next crack at overtime. That he didn't want. He said the company made a mistake and must pay up for it. He wanted pay for the hours he didn't work because it was company policy to rotate the men.

Sure, he said he saw the notice on the bulletin board but he didn't think of checking too closely. After all the overtime list was management's baby, not his; and if an error was made, it's not the worker's job to audit the copy. "Therefore, I'm entitled to my pay even though I didn't work."

Was the worker: Right ☐ Wrong ☐

What arbitrator ruled: "The policy of the company requires that overtime be divided equally as possible and practicable among the employees. It does not require that overtime be divided *exactly equal*. Its intent is to prevent discrimination in the division of overtime among employees. Four to eight hours difference in overtime between Dobson and Burnette does not amount to discrimination. It does amount to a mistake or an oversight and should have been corrected. It would have been corrected if it had been called to the foreman's attention. Burnette saw the list and he was therefore notified that he was skipped over. He had ample time to bring the error to the attention of the foreman. However the important point is that the company is not obligated to divide overtime exactly equal and in view of the fact that the error was not in malice I dismiss the grievance and direct the company *not* to pay for the time not worked."

Church lighting

(Continued from page 30)

engineering firm, Dixie Electric Company made a program of exhaustive tests which developed a combination of trough lighting and direct down-lighting, which would not only provide even lighting but would lend itself to uniform dimming of the over-all elimination without "too open light" at any point. To accomplish this, 52 Rambush 500-watt downlights were installed in the dome, spaced at carefully planned intervals to disseminate direct incandescent light over the pews and aisles. In addition, 156 incandescent 40-watt lights were installed in a cove trough around the lower rim of the dome, each with a silvered glass reflector to provide diffused reflected light, operated on the same dimmer switch as the direct downlight. These, despite the fact that identical wattage was used in the cove area, and within the dome itself, proved to develop the even flow of light over the entire area.

For the "mood lighting" 12 swivel-mounted colored spotlights were installed in a recess between the rear wall behind the pulpit, the dropped ceiling which forms an inverted trough running the full width of the platform. The 12 combination spot-flood lights with gelatine lenses, easily snapped on and off, are spaced the 20-foot width of the platform for ready focusing at any point.

A signal system for the programs are provided at the organ, the pulpit, and in a small room on the left of the platform, where the dimmer switch and main control panel are likewise installed. The combination of colors can be changed by remote personnel on signal from the pastor or other church officials on the platform or by an engineer stationed in the recessed room in the left rear corner of the building.

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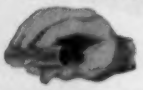
SNAPS TIGHTER,  **HOLDS ITS GRIP**

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Test instruments

(Continued from page 36)

reactive nature of the motor load. The magnetizing current drawn by the motor does no work and, consequently, is not integrated into a wattmeter reading. It is real current, however, and must be delivered into the motor windings through the same copper that carries the work producing current.

Most of your trouble shooting in alternating current power circuits will probably consist of load, power factor and voltage surveys of main or feeder lines; searches for faults and grounds; and correcting faulty operation in the control and power circuits of machinery.

Minimum instrumentation for satisfactory alternating current work should include a clamp-on ammeter and a clamp on watt or power factor meter. Clamp or hook-on ammeters are invariably designed so that voltage as well as current readings can be made. These instruments are extremely portable and while not precision instruments, they are very useful for checking current flow through main feeders and branch circuits to motors, transformer banks, etc. Accuracies of about three per cent are obtainable with this type of instrument. For highest accuracy and best results the manufacturer's instructions should be followed closely while the instruments are in use.

One popular type of clamp-on ammeter has six current ranges covering full-scale deflections from 10 amperes to 500 amperes and voltage scales of 150, 300 and 600 volts. This type of ammeter utilizes a rectifier type instrument connected to the secondary of a split-core current transformer, made so that the core can be closed around a current-carrying conductor which then forms the primary winding of the current transformer.

The secondary of the current transformer, as well as the moving coil of the indicator, is tapped to provide the various current ratios. Care must be taken to insure that dirt or lint does not accumulate in the air gap where the core separates. Any foreign material which can prevent sealing of the gap will cause the instrument to read low, because the reluctance of the magnetic circuit becomes greater on a gap length squared basis.

The current range of clamp type instruments may be decreased by looping the current carrying conductor through the core twice to cut the range in half, four loops for one-fourth, etc. Thus with four loops through the hoop and with the range selector in the ten ampere position, two and one-half amperes will produce full-scale deflection.

When the choice must be made between a clamp type wattmeter or power factor meter, the types of loads should be considered. The wattmeter might be preferred if there are many heating loads connected to the system, but the power factor type probably will be selected when all the measuring will be done in motor circuits. Clamp-on power factor meters are for use on balanced three-phase systems.

In larger plants, and even the smaller ones, when more extensive instrumentation is required to insure rapid restoration of service or production, "industrial analysers" or "a-c load visualizers" can be used. With these instruments, accuracies to one per cent or better are usually attainable.

The "industrial analyser" is bulky and heavy, having four instruments, volts, amperes, watts and power factor, along with the necessary multipliers and current transformers contained in a carrying case. All information about the behavior of a particular circuit is presented simultaneously. When using the industrial analyser, single- or three-phase balanced or unbalanced loads may be measured.

The "a-c load visualizer" is a single compact instrument also containing multipliers and current transformers, but here only one circuit characteristic at a time can be presented and some factors must be determined by referring to a chart or graph furnished with the instrument. The load visualizer is actually an ammeter having an auxiliary adjustable potential coil which balances out the reactive component of current as indicated by a dip of the instrument pointer as the coil is adjusted. This device may be used on single-phase and balanced polyphase systems only.

If single purpose portable type instruments are to be selected, the same general consideration out-

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lined for d-c instruments should be followed. Standard portable a-c voltmeters and ammeters indicate r.m.s. values and sturdy movable iron types are available with accuracies of better than one per cent. These instruments may be bought with one-, two- or three-scale ranges with voltage scales from 0-10 minimum to 0-750 maximum and current ranges from 0-1 minimum to 0-50 maximum. Most double-range portable ammeters are limited to 20 or 30 amperes on the high range scale. Triple range ammeters are usually intended for use with a current transformer at the highest range.

Heat pump installation

(Continued from page 28)

electricity as a regular air conditioning system. But with heat pumps, Allison eliminates the need for a cooling tower and pumps—and he eliminates a sizeable water bill (about 90,000 gallons of water a year), since the heat pumps use only air and electricity, and require no water.

(3) Heat pumps switch automatically from heat to cool (and vice versa). Conventional electric heating and air conditioning systems normally require hand switching from one system to the other, and drainage of water in the system with the advent of freezing weather. But the heat pumps keep the temperature at the desired level every day of the year—completely automatically—a particularly important advantage in the "in between" weather of spring and fall, when there's need for heating at night, cooling in daytime.

(4) Heat pumps supply fresh air constantly—and air that is filtered and conditioned. While electric air conditioning also does this job, conventional electric heating normally does not take in fresh air, nor does it filter the air. So with the heat pump, Allison's hatchery gets fresh air input—and air filtering and cleaning—every day of the year, not just in summer.

So Allison expects the heat pumps will save a lot of money on his electric bill, and will cost about 40 percent less to operate than resistance electric heat and conventional electric air conditioning. At an average cost of 2 cents per kilowatt-hour, this savings will amount to some $700 a year. However, since his hatchery is served by North Alabama Electric Cooperative (a distributor of TVA electric power), his average cost is about a penny per kilowatt-hour.

And since Allison's hatchery has not had air conditioning before, he believes the installation of year 'round air conditioning will actually make money for him.

For example, he is now setting 560 trays of eggs a week, with an average of 156 eggs to a tray. If he hatches just 5 percent more chicks from each tray during summer months, he will increase his live chicks by about 3,900 a week. And since chicks are now selling at 15 cents each, Allison would increase his income by nearly $600 per week—during the summer season—or about $11,000 a year!

Process stages

The electric heat pumps—by cooling in summer and heating in winter—help at every stage of the hatchery's operation. After the eggs come into the hatchery, first step in the process is "traying" them. On hot summer days, eggs can easily be damaged by the workers who put them by hand into the trays. Even temperature and humidity control will cut down summertime losses on handling eggs during the traying operation.

The heat pumps, by controlling room temperature and humidity, will make it easier for the setting incubator to do its job. Since temperatures and humidity are controlled in the room where the incubator is located, the incubator will not have to work so hard to overcome changing outside conditions. And, of course, the fact that the heat pump filters and cleans the room air will help the incubator.

The next stage is transferring the eggs to a hatching incubator, where they hatch in about three days. Here again the heat pumps will help the incubator to do its job of controlling temperature and humidity. The heat pumps should also help in summertime to cut down on smothering.

Finally, the one-day-old chicks are packed and shipped. And even while they are waiting to be packed, many chicks are smothered. With controlled temperature in summertime, Allison believes he can cut down on chick losses in this pre-packing period.

All of this adds up to more efficient operation of Allison's hatchery—and more profit for this progressive hatchery operator.

Contractors meet

(Continued from page 26)

national organization and said the hard core of NECA is the local chapter itself.

There are now 109 of these chapters, he pointed out. "These are your points of contacts and information. The chapter can accomplish much and most do," he said. "However, there are some which are just a name."

Mr. Geary, speaking on some of the problems that confront NECA, said that lack of new members is crippling some of the objectives of NECA. He said that NECA membership firms now employ 54 per cent of the electricians in contracting work but that it does not have a majority of electrical firms as members.

"We are not doing a good job of interesting contractors in our organization," he said. "There are many electrical contracting fields we do not occupy completely," he said. "These include house wiring,

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line work, motor repair work, and other work which are just as much a part of electrical contracting as any other. In electrical sign work, we have very few members."

Mr. Geary also asked the membership to aid in procuring new members of NECA and to stick to the high standards of ethical conduct that has been a NECA trademark.

Mr. Farley spoke briefly on what his department is doing for the organization in advertising and promotion. He said there were four steps in closing a sale: (1) arousing interest of the buyer; (2) creating a desire for a service; (3) establishing a preference, and (4) negotiating and closing a sale.

He said that NECA is a sounding board for the industry and that NECA spends money for advertising in newspapers and through other media.

Following this talk, a panel discussion was held with Mr. Burnett as moderator and with Mr. Geary and Mr. Teal on the stand. Local problems were aired including how to obtain new business and better paying business. Mr. Burnett urged an "available job survey" be instituted by all chapters.

The annual banquet was held that night in the main dining room of the hotel with Mr. Teal and Mr. Burnett presiding. The principal speaker was Harold S. Reeves, Charleston Social Security district chief, who gave a roundly-applauded talk on the Gullah (Negro) dialect.

Mr. Thurber was honored for his service to the industry and especially to the Third District of which he is regional director.

Allen C. Mustard, head of the South Carolina Electric & Gas Company's commercial power sales department, was the principal speaker at the morning session on the last day. He spoke of problems confronting the utilities companies and of the cooperation between these organizations and NECA, and outlined planned expansion in South Carolina.

An address on "House Power" by Mr. Farley ended the morning session which was followed by a luncheon for delegates given by chapter managers.

The final session was in the form of a panel discussion on House Power with Mr. Burnett again acting as moderator. Panelist included G. X. Barker, of Atlanta, vice-president of the International Brotherhood of Electrical Contractors; Mr. Mustard; Mr. Geary; Bert Petty of Chattanooga, IBEW vice-president, and W. Harold Butt, Butt Electrical Supply Co., Charleston.

The contractors explained that of the 20,000,000 homes in the United States, 99 per cent do not have adequate house power, a term coined to describe what capacity the modern home should be equipped with to get maximum results from today's many appliances.

The labor leaders were asked if they could supply or train men fast enough to fill needs that will be created by the development of millions of dollars worth of new wiring for old homes and for new homes. They replied that the unions could and would make these men available to the industry.

The convention was adjourned following a discussion of the events of the three-day meeting.

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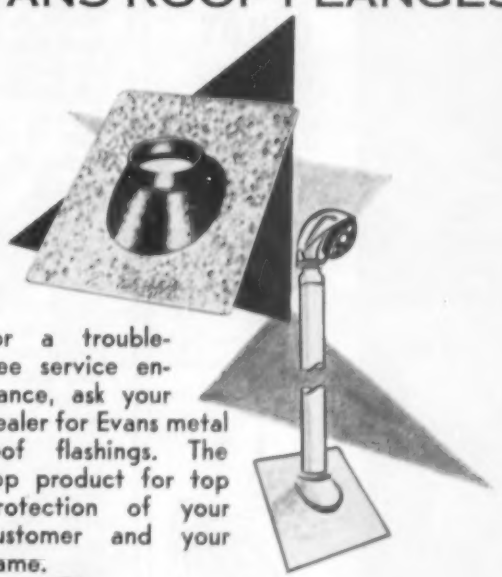

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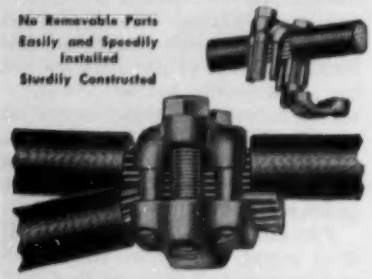

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tained on sightseeing tours of Charleston and surrounding areas. They were accorded a special luncheon May 10 at the Country Club of Charleston.

Textile wiring

(Continued from page 23)

ment in this matter, and will thereby guarantee to themselves the best possible assurance of getting the most for the money.

As a matter of fiscal policy, some companies with Engineering Departments are tempted to save an electrical consultant's fee on their new mill projects. In addition to sacrificing value of an independent consultant's contribution, this is often poor economy for a very practical reason. Only a few Engineering Departments are staffed to handle the design and supervision of a major project in addition to their normal work load. This sometimes leads to the soliciting of so-called "firm lump-sum" bids on the basis of very sketchy plans and largely verbal specifications. Even worse, bids may be solicited on the basis of competitive "designs" from several electrical contractors. The danger of securing the least work and the poorest bargain from the most unscrupulous contractor should be apparent. A third and equally dangerous pitfall, at least potentially, is the accepting of lump-sum bids from all who request the privilege, and the awarding of the job to the lowest bidder who can furnish a bond. Too often, by the time it is learned that low price rather than low cost has been purchased, it is too late to do anything which will remedy the situation.

We strongly recommend that electrical contracts be awarded on the basis of lump-sum proposals in accordance with detail plans and specifications prepared by a qualified architect-engineer who is up-to-date in your particular area of the textile field, and who is able to co-ordinate the electrical with all other phases of the construction program. It will be necessary to give him complete information, and sufficient time to do a good job. In co-operation with your architect-engineer, you should prequalify and pre-select a list of acceptable bidders. No prospective bidder should be included unless he can be thoroughly investigated, and proposals should be considered from this group only. Carefully controlled use of this procedure will reduce quality and quantity competition among the bidders to the vanishing point, and go far to assure fair price and value for the specified work.

In circumstances where the lump-sum bid procedure is not used, we believe that the only safe course of action is to select one contractor who has earned, or proves that he merits, your complete confidence, and to negotiate some form of fixed-fee, cost-plus, or upset-price contract with him. This contract could include the necessary design engineering, but preferably that would be handled, at least so far as the basic design is concerned, by an independent consultant. As in the case of lump-sum contracts, this procedure can produce entirely satisfactory results in terms of the most for the money IF the right contractor is selected.

In conclusion, it is clear that this paper has failed to develop any magical chart or formula to solve the economic problems of low-voltage power distribution in textile mills. At the same time, if the paper has aroused enough interest to encourage further study in this neglected field of economics, it will have accomplished its principal purpose. Meanwhile, it may be that one or more of the suggestions herein will help the reader to get or give more for the money the next time you buy, sell, design, or install a low-voltage power distribution system.

Service equipment

(Continued from page 19)

computation of load which usually was made out by one of our master electricians. To save the precious time of our electricians, we have designed a form that can be filled out by our bookkeeper.

Our sales department is vitally affected by our new approach to installations. Of the five notebooks we have prepared of our 22 photographed services, three were placed in the hands of our estimator-salesmen, one in the display room, and one at the shop mechanic's workbench. We can now employ a man more sales-minded than electric-minded who, with notebook in hand, can show a customer precisely what service equipment is going to be installed. With pre-arranged equipment at his disposal, our estimator-salesman does not have to design an ar-

rangement of panels, etc.

He can point out to a customer comparative services such as the 100-ampere and 160-ampere service equipment in fuses and circuit breakers and explain what the $50 difference in price brings him, or why the more economical service might do the job just as well.

For the benefit of the customer who might like to see the actual service equipment and fuse panel he is going to invest in, we have set up in our showroom our 22 services in complete detail as they would appear in a customer's home. This is a further means to effective selling.

I can not estimate in dollars and cents the time and effort and study our new setup required of me and my staff. Photographing the 22 service equipment panels for our five notebooks cost $350. But that is a minor item compared to the hundreds of man-hours spent working out the best methods in assembling each service, setting up our stockroom, preparing forms, and a number of other details.

Unforeseeable by-product benefits appeared, too, once the setup got rolling. A young apprentice working under the supervision of a master electrician in the shop gains skill and know-how so much faster than when out in the field. By the same token a company can personally watch each job being set up in the shop which it cannot do when jobs are assembled in the field.

Space limitations in the warehouse keep us just a few jumps ahead of installations with a two or three month supply for busy seasons. On our most commonly used services such as 160-ampere fuse panel inside meter, and 160-ampere fuse panel outside meter, we prepare for the air conditioning season with 50 of each all made up and ready to go. As an economical service, this is most widely used with air conditioning rewiring jobs for lower-income customers.

Anticipating a peak season, we have put 100 of these services into stock. A pre-assembled service actually has us up and on our way at a moment's notice to get that air conditioner into operation for the lady who cannot tolerate the heat another second!

All of us—our mechanics, estimators, office personnel and I—believe we have hit on a system that has lightened the load for everyone. As a setup adaptable to any small or large size electrical contracting operation handling residential wiring jobs, it would bring rewards exceeding the effort and time put into planning and installation.

Drive-in service

(Continued from page 21)

located. At this point they are transferred to a traveling crane and taken to the stripping department if they are to be rewound."

Besides customers, salesmen calling on the company can use the free parking space on the second floor. There is space there too for the company's trouble-shooting truck, as well as cars used by the company's officials and salesmen.

The third floor of the new building has a hatchway, over which has been installed a three-ton hoist. That makes possible storing large reels of cable there, which the old building could not handle.

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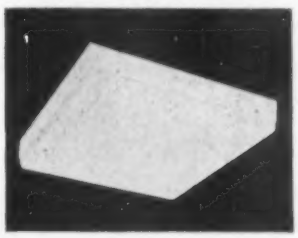

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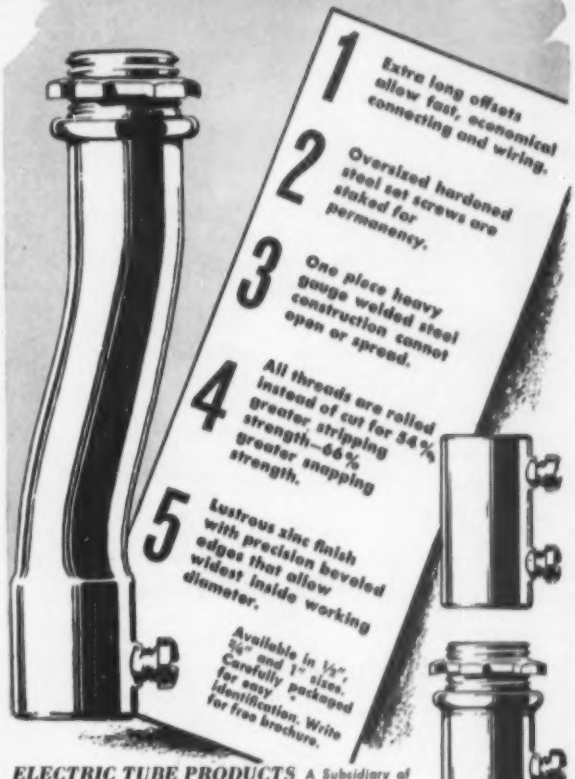
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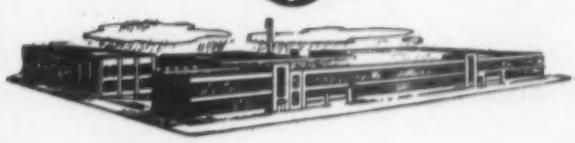

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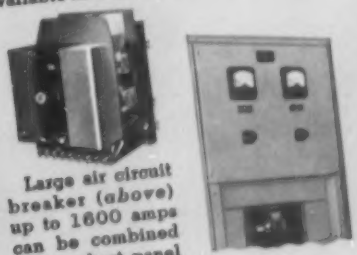
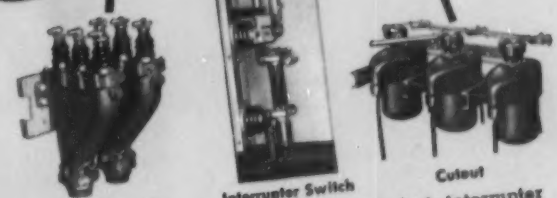


Large air circuit breaker (*above*) up to 1600 amps can be combined with a short panel in one section.

REAR VIEW

3 single phase, dry-type transformers individually mounted on base in ventilated enclosure—heating and vibration held to a minimum. Transformers easily accessible for maintenance and inspection. When no air circuit breaker or metering equipment is used, entire area at top left is available for pull box.



Pothead — Interrupter Switch — Cutout

Potheads, fused or unfused load break air-interrupter switches and fused or unfused oil-filled cutouts are available. Air-interrupter switches and cutouts are easily accessible from front of Substation.

SQUARE D COMPANY

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

hines were repeatedly

"Our Welding Machines were repeatedly being shutdown . . *until we changed to Fusetron Fuses"*

"They eliminated production losses due to needless fuse blows."

"Our service shop is headquarters for the Detroit area of Fruehauf's operation. Trucks, tractors and trailers come in for repairs.

"As you know, motor carriers don't make money if they aren't hauling freight. It's our job to have the equipment rolling — and fast!

"But we were having trouble with shutdowns. Ordinary 60 ampere fuses were constantly blowing on our welding machines. We have 12 of these machines — that can be connected to 60 ampere switches located throughout the shop.

"Since many major repair jobs require welding, these shutdowns were really a serious problem for us.

"In an effort to avoid these shutdowns, we installed Fusetron fuses. Since changing, there hasn't been any needless fuse blowing on the welders. Fusetron fuses completely eliminated the trouble."

Clyde Parkins CHIEF ELECTRICIAN
Detroit Branch • Fruehauf Trailer Company, Detroit, Mich.

EVERYONE IN THE PLANT CAN BENEFIT BY USING

Fusetron DUAL ELEMENT Fuses

They Provide 10 Point Protection

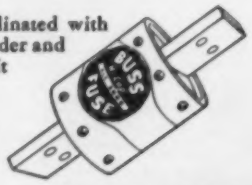
1. High interrupting capacity—protect against heaviest short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.
4. Provide thermal protection—for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors—without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money—permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

— Write for bulletin FIS —

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS . . . USE BUSS HI-CAP FUSES . . .

They have unlimited interrupting capacity to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.



Write for bulletin HCS.

Play Safe! install Fusetron and BUSS Hi-Cap Fuses throughout the entire Electrical System.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN MFG. CO. (Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.